the OIL AND GAS JOURNAL
PUBLISHED WEEKLY AUGUST 21, 1961

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Continental takes ACT a step further—and saves money
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Gulf Coast girds for a new era in oil hunting
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Lane-Wells has the *RIGHT* logging package for your well

Developing the maximum information from a logging program depends on having the right log at the right time for the specific conditions of your well. In Lane-Wells' wide variety of reliable logging services you will find the right tool or combination of tools for every hole condition.

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OIL AND GAS JOURNAL
Vol. 59, No. 34

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Drilling-Production

Getting Small Volumes from Mud Pumps 82

By Walter E. Liljestrand

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How to Cut Operating Costs 20% 106

By W. B. Bleakley

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Pipelining

El Paso's Dynamic Analysis Program 91

By Henry B. Martch, Jr.

A transient-flow equation, in conjunction with suitable mathematical representation of compressor stations, forms a mathematical model of a portion of the El Paso Natural Gas system. Computer solution enables investigation of the various effects resulting from changes in sales and operations.

Map Pictures Vast Expansion Project 117

Northern Natural uses 64-sq.-ft. map which is updated daily to keep operations, engineering, and construction divisions advised of progress on four-state, 1,100-mile project.

Refining-Processing

Steam Spraying Microbiocides Protects Cooling Towers 94

By John A. Germ, Jr. and J. M. Hindman

A "steam-spray" method of treating cooling-tower lumber to control fungus attack is showing good results. The method consists essentially of using a steam-distribution system to spray nonwetted areas instead of doing it manually.

System Provides Precise Control of Deisobutanizers 98

By Willas L. Vermilion

A control system based on temperature differentials in the bottom section of a debutanizer tower has been developed to maximize fractionation efficiency. The system aims at precise optimum overhead purity.

How Dow Insures Safety of its Pressure Vessels 102

By C. E. Lautzenheiser and F. B. Crouch, Jr.

Dow Chemical Co. implements emphasis on safety in operations by vessels constructed in accordance with proper codes and approved welding procedures. A design engineer reviews all test information and data. Periodic checks are made. Corrosion is calculated, and date of next inspection is projected.

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Plotting equilibrium curves.

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Process changes requiring major capital investment come often.

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Sulfur recovery from H_2S gases big business—Heavy fuel is good coke substitute in blast furnaces—Valve clamp speeds repairs.

THE OIL AND GAS JOURNAL **Newsletter**

August 21, 1961

Significant this week

Financially, independents and smaller integrated oil firms are doing all right this year—but the picture isn't dazzling.

First-half reports show their situation can't be called nearly so good as that of the majors.

For a few companies, earnings ran well ahead of the 1960 first-half performance. Only nominal gains were scored by most others. And there were some declines.

Hopeful note: A number of independent executives are sure the oil industry will share in general improvement of the national economy during the last half (p. 53).

Demand for jet fuels is sure to mount in next few years.

One big factor in rise will be supersonic transport, expected to appear in early 1970's. It will use six times as much fuel as long-range jet of today.

Supersonic transport won't be able to use current fuels. They aren't suited to high temperatures and other conditions of faster-than-sound flight. That means new, low-cost fuels must be developed—and aircraft manufacturers and fuel suppliers are already worrying about the need (p. 56).

Insiders say Texas Gov. Price Daniel will appoint Ben Ramsey, state's lieutenant governor, as successor to late Olin Culberson on Texas Railroad Commission (p. 74).

History-making decision on new allocation formula for Normanna gas field is drawing closer.

Texas Railroad Commission has called for written briefs from Normanna operators who appeared at heated hearing in Austin last week. Commission has been ordered by state Supreme Court to adopt allocation rule that would be fairer to large-acreage holders in Bee County field.

New formula, which will be unveiled after briefs are in, may decide fate of small-tract drilling in Texas (p. 70).

Streamlined ACT project's saving money for Continental Oil in Kansas' Geneseo pool.

Under program, crude from 10 different leases and a waterflood project is handled through one ACT unit and three major metering and test centers.

Continental has already made sizable cut in costs through

use of method. Now application is being extended (p. 66).

Look for new era of deep exploration on Gulf Coast.
Key concept in this coming play: Reefs.
Up to a few years ago, idea of deeply buried Cretaceous reefs was just theory to Gulf Coast oil hunters. Deep Edwards drilling changed that. Now the stage is being set for feeling out Cretaceous surface along a 700-mile trend, particularly the hard-rock Comanchean surface. Hundreds of deep wildcats will be required for this campaign (p. 72).

Will Russia succeed in its drive to make natural gas a major source of domestic energy?
Former FPC commissioner William R. Connole thinks the answer is yes. He traces the impact of the gas-development program on Russia's economy in the third of a series of articles written especially for the Journal.
Connole, one of the American gas men who toured the Soviet Union this summer, says his delegation came away with the impression that the Russians haven't bitten off more than they can chew. They'll hit rough spots in their tremendous expansion of the gas industry, but on the whole it's a safe bet soviet ambitions will be satisfied (p. 62).

News in the making

Here's the current outlook for natural-gas regulation:

—FPC's Joseph Swidler will play down need for immediate legislation. This indicates administration intends to keep silent on such bills as H.R. 7575 (Harris bill). If so, these proposals will wither on the vine.

—Area-pricing approach, which is stalled now, probably will be abandoned.

—Move may develop, under Swidler's chairmanship, to exempt small producers and apply tight regulation to big producers. Pitch will be that this would provide adequate consumer protection while freeing FPC's logjam of cases.

—Such plans will jell fairly fast if L. J. O'Connor, Jr., newest FPC member, sides with Swidler and Howard Morgan to provide commission majority. Otherwise, no real progress will be made until successor to late Frederick Stueck is chosen.

Capacity of at least 55,000 bbl. daily is planned for the refinery Standard of California will build after buying Standard of Kentucky.
Socal says in proxy statement that plant will be as large as permitted under consent decree approving sale. Decree says Socal can get 55,000 bbl. daily of products from its own sources. Plant also will include petrochemical works. Site hasn't been selected, but will be in southeastern U. S.

Tanker owners and union men are being prodded to parley seriously as truce in maritime strike enters last month.

Pressure comes from three-man presidential fact-finding board which recommended use of Taft-Hartley injunction in bringing about cooling-off period. Board has called meetings between tanker owners and Marine Engineers Beneficial Association for August 22 and between tanker owners and Masters, Mates, and Pilots for next day.

Peep at 1962 autos that will be unveiled in Detroit next month would show:

Higher compression ratios, longer crankcase drain periods, more "greaseless" cars, new medium compacts from Ford and Chevrolet.

Compacts now are taking a third of the market—and the share is expected to increase in the 1962-model year.

Pipeline-construction boom is creating fears that shortage of skilled welders may develop.

Pipe Line Contractors Association has asked contractors not to offer bonuses or other inducements that might aggravate situation.

Worth watching: Gas wildcat in Grimes area of California's Sacramento Valley that may mark another discovery.

T. A. Atkinson's 1 Atlantic-Guisti tested 5,500 M.c.f. daily from 6,260-6,310 ft. last week. If it's completed as a discovery, the wildcat—5 miles east of Grimes field—will be second gas find in area this month.

Oregon may kill chances of luring some oil explorers offshore if it goes through with proposal to demand new royalty.

Proposal calls for sliding-scale royalty beginning at 16⅔%. State's attorney general favors sliding-scale royalty similar to California's unpopular royalty program which goes up to 50% for a 580-bbl. well.

Increase in U. S. rotary-rig activity continues.

During week that ended August 14, there were 1,870 rigs at work—biggest total since May 1960, when 1,895 were operating.

Wildcatters are pressing search for more oil reserves in Alaska. Richfield Oil has suspended a test in Yakataga area and now will drill 1 White River about 18 miles to southeast; Standard of California will drill 1 Anchor River 4 miles west of Kachemak Bay.

Next step in Institute of Gas Technology research on underground storage is expected to be construction of a tank for storing liquefied natural gas.

Tests for underground storage of liquefied methane in concrete tanks already have been finished. AGA sponsors project.

Market memo

Aug. 21, 1961

The entire industry seems destined for a real price workout, as gasoline pricing definitely has entered a new phase.

Almost everywhere you look in the East there's a price war. And the main reasons are pricing innovations of majors aimed at meeting scrappy private brands head-on.

Gulf, after initial tests in San Antonio, now has its sub-regular Gulftane in four more markets—Indianapolis, Buffalo, Newport News, and Norfolk, all with histories of chronic price troubles (p. 69).

Prices, as a result, are scrambled. Price for regular dropped 6.7 cents in Buffalo, 6 cents in Indianapolis, and 2 to 3 cents in the Virginia points.

Sun still has its two sub-regulars in Charlotte, where price for regular still is 2.5 cents off normal, and there's talk that Sun may introduce its nine-blend pump in cities where Gulf has started offering Gulftane.

Other price trends:

The pressure is on Mid-Continent marketers now to move all gasoline possible before Labor Day. As a result, prices have eased off another one-fourth cent on the spot market with regular at 11.00 to 11.25 cents per gallon. There's little activity yet on distillates, but a pickup is coming, and suppliers already are talking of as much as one-half cent price rise before the season gets too far along.

On the Gulf Coast, the gasoline market is fairly firm with spots probably one-fourth to three-eighths of a cent off postings. Stocks are in good shape despite heavy refinery runs lately with only three cargoes available for late August lifting. No. 2 is firm at 8.5 cents with interest quieter now because of the continued low price on the East Coast.

The Mississippi River has gasoline at one-eighth to one-half cent off the gulf low. No. 2 is in fair shape for the season after recent sales for down-river movement.

Refinery runs remain high. They came down only 29,000 bbl. daily last week to average 8,437,000 bbl. daily, still 102,000 bbl. daily higher than last year at this time. Average for last 4 weeks is 8,396,000 bbl. daily, second highest on record.

Gasoline stocks eased off only 944,000 bbl. during the week to total 192,098,000 bbl., up 260,000 bbl. over last year.

Marketing notes: Eleven majors have been enjoined by an Oklahoma City district court from selling gasoline below cost in violation of the Oklahoma unfair sales act. Quality Oil Co. President A. B. Green asked the injunction plus $1 million damages. Hearing has been set for Sept. 28. Oklahoma law forbids sale of goods at less than invoice or replacement cost plus 6% markup and cartage expense . . . **Utah's new law** restricting size and placement of gasoline price signs in service stations has been declared illegal as an unlawful interference with private business. Decision may be appealed by the state to the Utah Supreme Court. Law limits signs to 12 in. high and restricts location to gasoline pumps.

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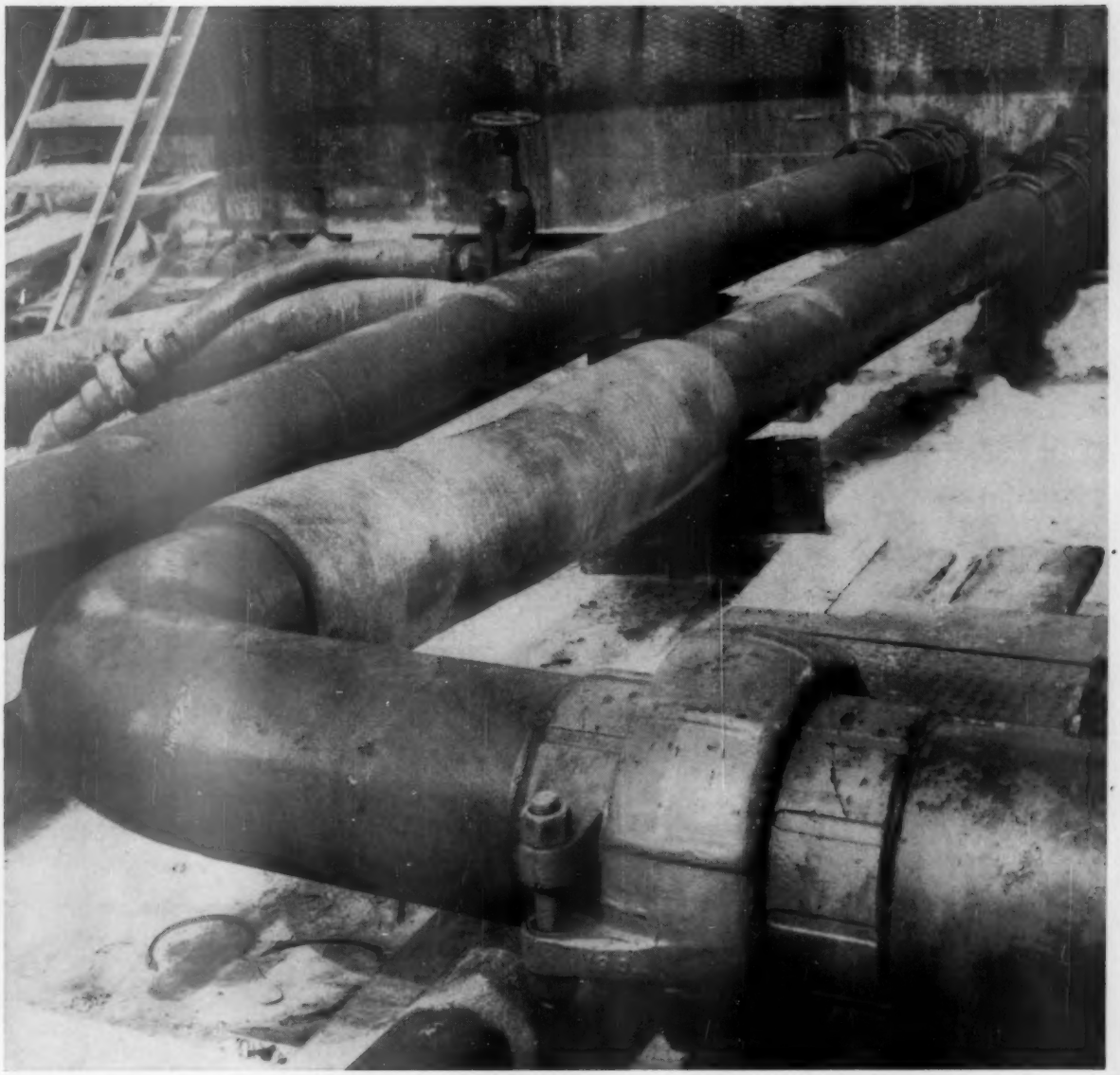

Rubber calms the shudders that used to shorten pump life

DESTRUCTIVE vibration from a pounding mud pump is completely absorbed by B.F.Goodrich mud pump suction hose. As a result, both the hose and the pump last longer.

To deaden vibration, B.F.Goodrich engineers made the hose more flexible. Rayon cord is used for reinforcement, rather than the stiff, wrapped plies of fabric found in ordinary hose. The cords run parallel with no cross threads to tie them together, are completely surrounded by rubber. They are free to "give" and absorb the destructive shaking action of the mud pump.

For protection against abrasive mud, the tube of this hose is made of a special compound that outwears steel. It is oilproof, has a smooth surface so mud flows through at high speed.

This BFG hose is built to take full vacuum. A spiral of heavy spring steel wire, imbedded in the hose, prevents collapse, increases crush resistance.

You'll find B.F.Goodrich mud pump suction hose at leading supply stores in the oil field, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Shreveport, Hobbs, Oklahoma City, Tulsa, Corpus Christi, Dallas, Houston, Odessa. *B.F.Goodrich Industrial Products Co., Dept. M-129, Akron 18, Ohio.*

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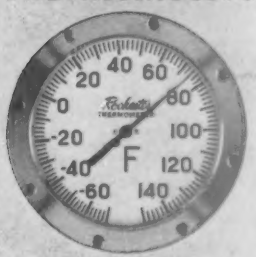
Industrial Thermometers



Rochester bimetal industrial dial thermometers provide extreme accuracy, are hermetically sealed and can be externally calibrated. Available in standard dial sizes from 1" to 5", and with scale ranges from minus 150°F to 1000°F.

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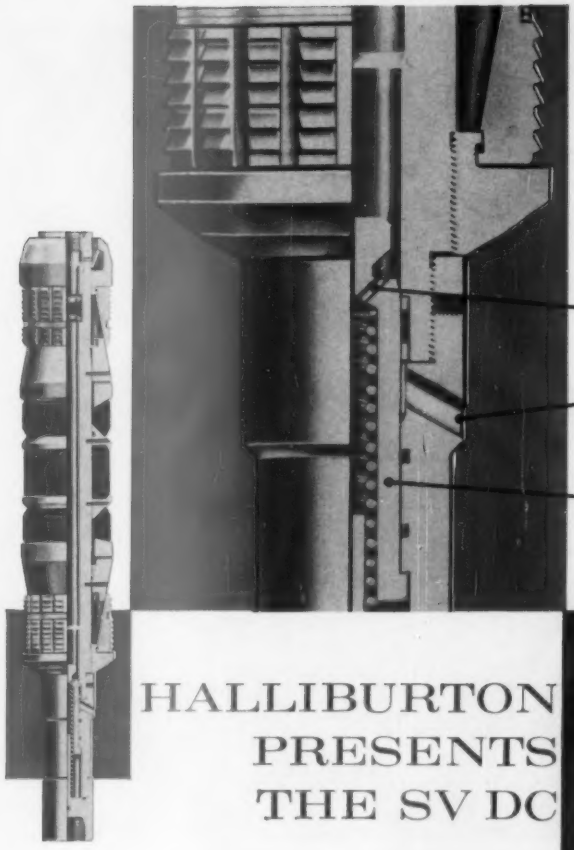

SV DC
Squeeze Packer
and
Circulating Valve

HALLIBURTON PRESENTS THE SV DC

ANOTHER IMPROVEMENT IN SQUEEZE PACKER DESIGN

SV DC PROVIDES OPERATING VERSATILITY

The Sliding Valve in the Halliburton drillable cast iron SV DC Squeeze Packer provides unique benefits before, during, and after the squeeze job. The pressure balanced sliding valve may be opened or closed *at will* any time simply by raising or lowering the tubing. This permits flow-through of well fluids during run-in on tubing; pressuring-up above or below the packer for testing packer seat and tubing; circulation; squeezing; and reversing out excess cement.

EXCLUSIVE Sliding Valve Features:

★ Pressure balanced sliding valve can only be opened or closed *mechanically* by raising or lowering tubing. The pressure balanced port in the valve equalizes pressure across the valve to permit effective holding of pressure from either direction.

★ Mechanical operation of the sliding valve eliminates necessity of dropping or pumping down sealing ball or plug for shut-off.

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★ Forms an effective fluid tight drillable casing packer, for squeezing cement below through tubing or drill pipe.

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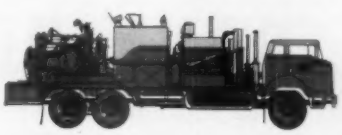

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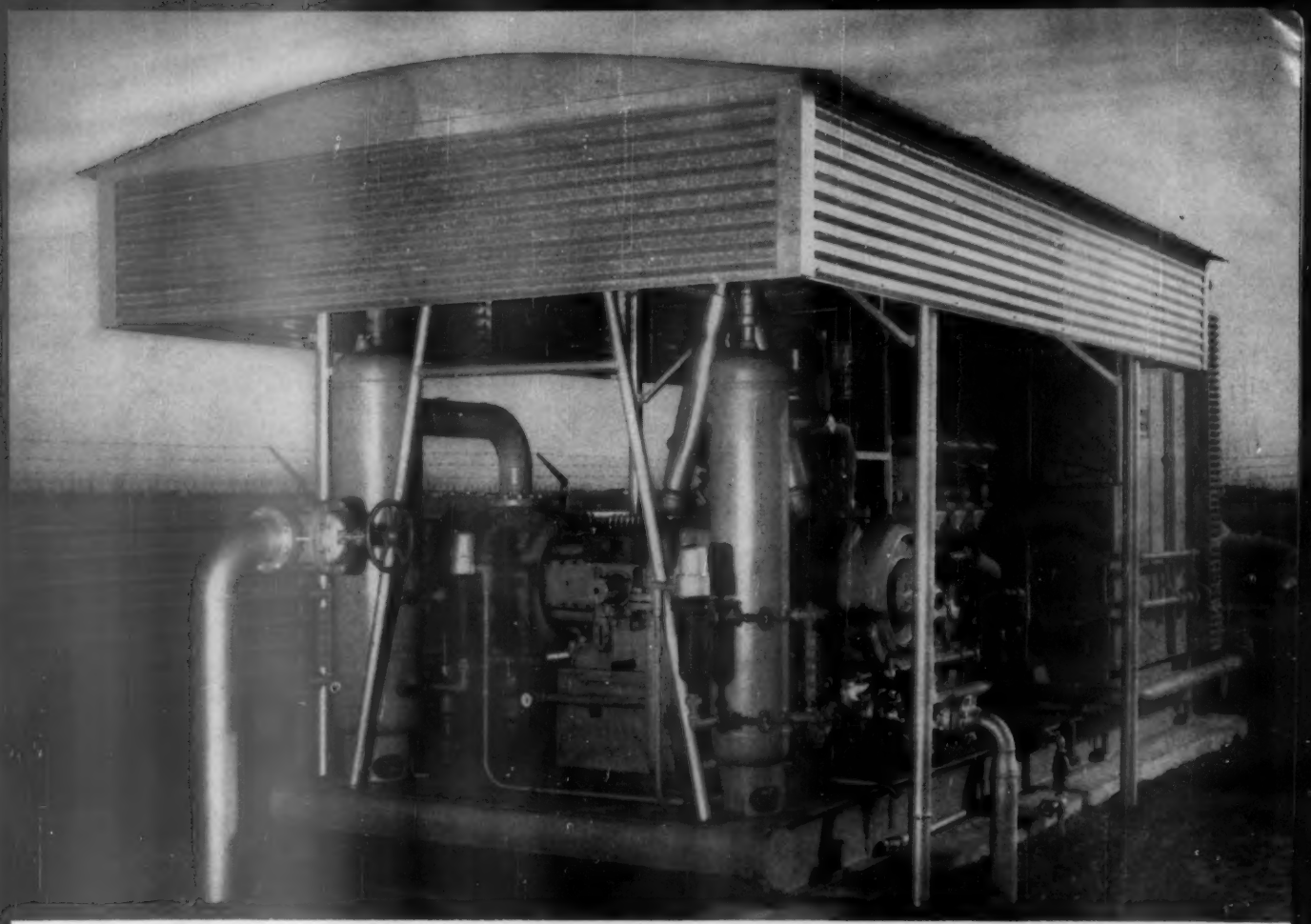
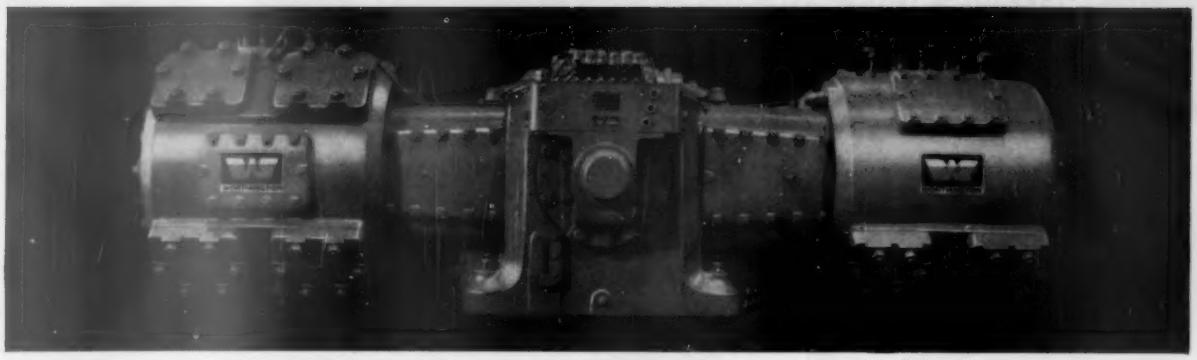




SHOULD YOU TAKE GAS FROM A WELL?

There's a big difference in opinion about when it is profitable to take gas from a well. It depends on price contracts, on company policy of time limit on payout, on alternatives for capital investment and on other factors, such as the economics of the well itself. To lower your well cost picture, Worthington now offers the new CUB compressor.

Through a wide range of cylinder sizes, the CUB handles over 85% of gas field needs. The cylinders are designed for extremely fast field changes to meet changing capacities and pressures.

The CUB cylinder-and-piston arrangement is balanced-opposed. This cuts vibration to a level below other compressor designs. It reduces supporting base requirements and lengthens compressor life.

Main crankshaft bearings in the CUB are the more expensive, spherical-roller-bearing type. You'll find it runs with less friction, runs cooler, and maintains better full end-thrust control.

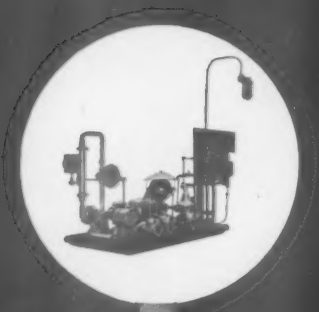
Lubrication in the CUB is improved, too. Oil is continuously cleaned by a built-in filter that is readily serviced without disturbing piping. All lubrication is done by a full, force-feed system. And crankcase oil is water-cooled down to a conservative operating temperature by an oil cooler enclosed in the frame itself.

You'll find, too, that the CUB is compact to make an easier installation. Piping is less, only one water inlet and two water outlets. There are no external oil pipe connections.

For more information on the CUB, write Worthington Corporation, Section 36-19, Harrison, N. J. In Canada, Worthington (Canada) Ltd., Brantford, Ontario. Or call your local compressor packager.

WORTHINGTON

PRODUCTS THAT WORK FOR YOUR PROFIT



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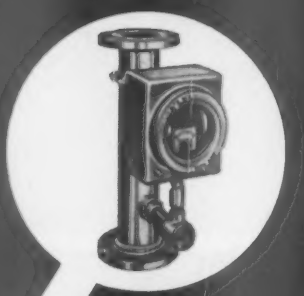

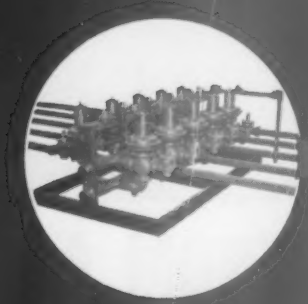

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Quick-Change, Knuckle-Joint Swab
Change cups without tools in ten seconds. Type UF or Multiwing Cups float on mandrel and serve also as valves. Knuckle action permits easy running of multi-cup units by adding mandrels and cups as desired. Only three metal parts.

Type UF Swab
. . . a threaded joint swab otherwise similar to knuckle-joint swab in 2" - 3½" sizes. Slightly different design in 1", 1¼", 1½" and 1¾" sizes. Use with Type UF and Multiwing Cups.

Types UF and Undersize UF Cups Flexible all-purpose cups with heavy wall and extra length for lifting heavy loads . . . light loads, too, from great depths. Serve as valves on swabs shown. Sizes from 1" through 3½", also undersize cups for swabbing restricted tubing.

Multiwing Cups
Especially effective in fluid containing high ratio of sand. Eight upturned lips integrally molded with built-in relief features provide maximum clearance for fast falling. Pass easily through tight spots and automatically dump excess. Sizes from 1" through 3".

Guiberson cups and swabs are the result of the best engineering and field-proved experience, plus the finest, most complete product production facilities in the world.

Yes, you can count on Guiberson quality . . . and because the Guiberson line is a complete line, you can get the swab and cup you need to do any job better. The swabs and cups shown here are just a part of the nine types of cups and suitable swabs from 1" through 13".

You can count on your Guiberson representative to recommend the cup and swab combination best suited to your particular needs.

Better be Safe than Sorry — go Guiberson

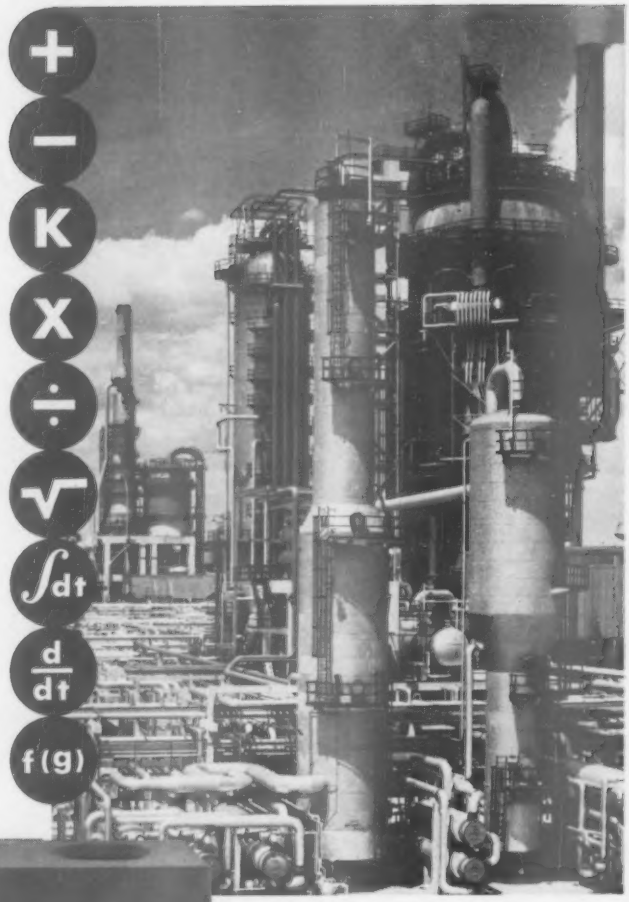
THE GUIBERSON CORPORATION
DALLAS, TEXAS, U. S. A.

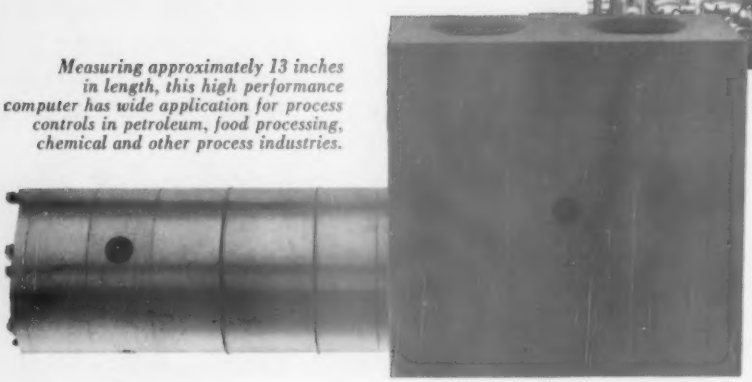
SAFE THAN SORRY GUIBERSON BETTER BE

PRODUCTION, DRILLING AND WORKOVER SPECIALTIES, MOLDED RUBBER PRODUCTS

DRESSER INDUSTRIES INC.
OIL • GAS • ELECTRONICS
CHEMICAL • INDUSTRIAL

AiResearch introduces pneumatic computer to the process industry





Measuring approximately 13 inches in length, this high performance computer has wide application for process controls in petroleum, food processing, chemical and other process industries.

Provides control accuracy within 1%

- ***Performs all necessary mathematical functions***
- ***Utilizes existing plant instrumentation***
- ***Can receive and transmit electrical signals***
- ***Comparative low costs assure rapid pay-out***
- ***The building block technique of modular construction assures flexibility to cope with problem changes.***

The AiResearch Special-Purpose Pneumatic Analog Computer is the next evolutionary step in process control. It assures continuous on-line solution within one percent overall accuracy of expressions or equations requiring as many as 10 or more mathematical functions.

AiResearch can (a) mechanize your control expressions, (b) assist you in formulating the control expressions and mechanize them, or (c) present you with a packaged system.

This industrial computer system is a result of more than 20 years of experience by AiResearch in the design and manufacture of pneumatic, hydraulic and electronic control systems and components.

• Please direct inquiries to Controls Systems, AiResearch Phoenix Division

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Systems and Components for: AIRCRAFT, MISSILE, SPACECRAFT, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

For trouble-free service on high pressure lines

NEW FISHER 404

high pressure relief valve

- **POSITIVE SHUT-OFF**
  Numerous field tests show that the 404 gives bubble tight shut-off under all pressure drop conditions.
- **ACCURATE AND DEPENDABLE**
  Repetitive operation, frequent or infrequent, does not interfere with its ability to relieve consistently at its predetermined setting.
- **SIMPLE AND COMPACT**
  Only one moving component in main valve. Only adjustment is pilot spring setting. All internal parts can be removed or inspected in minutes without special tools and without removing the valve body from the line.
- **LARGE CAPACITY**
  Provided by full port body and pilot operation.
- **SUITABLE FOR GAS OR LIQUID RELIEF SERVICE**

SPECIFICATIONS

Body Sizes—2″ Screwed; 2″, 3″, 4″, and 6″ Flanged.

Body Material—Cast Steel.

Valve Disc Material—Composition.

Body Trim—316 Stainless Steel.

Relief Pressure Ranges—30 to 600 psi.

FOR COMPLETE DETAILS WRITE FOR BULLETIN P-404

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

FISHER GOVERNOR COMPANY

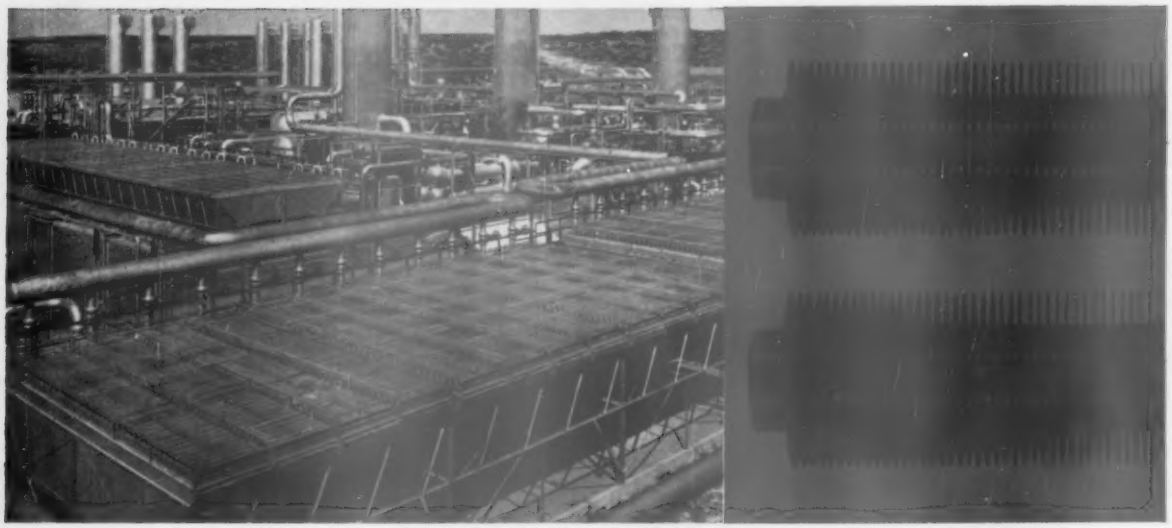
Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

FISHER Control

SINCE 1880

IT'S CHEAPER TO KILL HEAT WITH AIR



COMPARE TRANSAIRE . . . no matter what your water situation. Transaire air-cooled heat exchangers already have found wide acceptance in areas where water cooling is impractical or impossible. And now, finding that Transaire is less expensive to operate, even where water is plentiful, other areas are turning to this economical unit.

Simple in basic design, Transaire units are being used in many varied operations where low maintenance and low operating costs are important over extended periods of time. The high heat transfer efficiency is attained by use of the Yuba fintube. Its exclusive design employs tapered spiral fins mechanically bonded so that the entire base tube is covered and protected against the galvanic action that destroys efficiency in many other types of fintube. Both fins and base tubing can be provided in almost any material, size or gauge desired. Fin spacing and height can be varied to requirements. It's cheaper to kill heat with air – next time compare Transaire, a product of Yuba, pioneers in air-cooled heat exchangers.

Yuba also manufactures a complete line of shell and tube heat exchangers, and will recommend either type, whichever is required or best suited for the job.

YUBA

specialists in heat transfer equipment

YUBA HEAT TRANSFER CORPORATION
Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

Sales Offices in Chicago • Houston • Los Angeles • New York • Pittsburgh • San Francisco

INTERNATIONAL LICENSEE: Birwelco Ltd., Birmingham, England (United Kingdom, British Commonwealth).

Formjel gives a penetration block ...not just a well bore coating!

BJ Service

FORMJEL

Formjel gets results where other methods fail because it penetrates and blocks *within the formation* rather than at the well bore alone. Another exclusive BJ Service development, this tough blocking agent has a variety of applications in acidizing and fracturing. It can be spotted to block one zone while another zone is treated... to stop channeling behind casing set through pay zones... to seal leaking packers... to block formations above or below a packer against vertical communication ... and to help achieve multiple fractures. Formjel has exceptional viscosity, zero API fluid loss and can carry solid blocking materials. Available in Regular Formjel which breaks completely in 5 to 24 hours, or in Long-Lasting Formjel which provides positive blocking action for up to 16 days.

For complete details, call your local BJ Service field station today.

Results talk!

Formjel Stops Mud Loss Into Production Zone Where Oyster Shells Failed in Carter County, Okla.

PROBLEM: To stop mud loss into Flat Top Formation during cleaning out and milling operation. 1,600 lbs. of oyster shells—a solid blocking agent that is usually effective—failed to stop lost circulation, which reached 50 bbls./hr.

SOLUTION: Formjel was applied through the drill pipe in two 1,000-gallon stages. It effected a reduction in mud loss to less than 1 bbl. per hour for the remainder of the cleaning-out period—one week.

BJ SERVICE, INC.

A BORG-WARNER SUBSIDIARY

Long Beach, California • Arlington, Texas • Stations in all major oil fields

BJ B-W SERVICE

The "OILWELL" string...

PRODUCTS
SERVICES
STORES

Why it's called the "cold sweat" period

It starts when the switch is thrown and the valve opened to give life to the pumping unit on the new well. It lasts until they see what "pumps up." The interval is "cold sweat" because no one can afford losing money on faulty equipment. One way to make sure you get the performance you pay for is to use "Oilwell" equipment and the services of your "Oilwell" field engineer. His job is to see that the proper planning goes into the installation from the start. He'll gladly supervise setting the unit up. And to make sure he's done his job right, he's usually on hand during the "cold sweat" period.

"Oilwell" engineers are no further away than your telephone. They're a big reason why you get much more than a piece of equipment when you buy from "Oilwell". If you need equipment, or if you simply need advice, the best place to call is "Oilwell".

For a longer run for your money switch to "Oilwell" Subsurface Pumps

"Oilwell" has been throwing money "down the hole" for years with one thing in mind: to beat torturous hole conditions where subsurface pumps *must* perform to turn a profit. Every dollar we've spent in subsurface pump research and design has paid off in longer life, less "pulling" and lower lifting costs.

There are no less than 7 different kinds of "Oilwell" subsurface pumps from which you can choose, each tailored for specific hole conditions. Standard wall and heavy wall rod pumps, sectional liner rod pumps, and tubing pumps are available in all API types, and every "Oilwell" pump features *Streamline Flow* design that lessens wear. Select from these famous performers to suit your requirements.

DI-HARD—has locked-liner construction and low coefficient of friction and is highly corrosion resistant.

SILVERLINE—for medium depth wells where corrosion and abrasion pose no serious problems.

HI-BRIN—features the hardest one-piece barrel you can buy. Resists hydrogen sulphide corrosion.

NITRILINE—a moderately priced hardened barrel for abrasive and mild corrosive wells.

SPUN METAL—Barrels are cast liner type. For most wells containing medium CO_2 or medium H_2S corrosion with medium abrasion.

KROM-I-DEE—for combating sweet corrosive fluids and to resist abrasion in extremely sandy wells.

THREE-TUBE—chrome surfaced tubes and fluid seal minimize abrasive action of sand. Outstanding where there's floating sand.

For more information, write for a free copy of our 38-page booklet, **Selection and Application of Subsurface Pumps.** Or visit your nearest "Oilwell" store and talk with our Pump Specialists.

No white mice here

Believe it or not, it costs less to drill a foot of hole today than it did 100 years ago. Research and technology have turned that incredible trick by cutting drilling weeks to days, reducing costly fishing trips, doubling and tripling equipment life. Look a little beyond most of these remarkable developments and you'll find the name "Oilwell". It takes the finest research facilities to help win the battle for lower costs, the kind of facilities you'll find in "Oilwell's" laboratories and United States Steel's Research Center at Monroeville, Pa. In the picture, a USS basic researcher is probing the causes and cures of corrosion by analyzing the nature of thin oxide films on steel surfaces. There may be white mice somewhere else in the lab, but here the basic idea is to lead the way to longer-lasting equipment for corrosive wells.

USS, "Oilwell", DI-HARD, HI-BRIN, KROM-I-DEE, NITRILINE and SILVERLINE are registered trademarks.

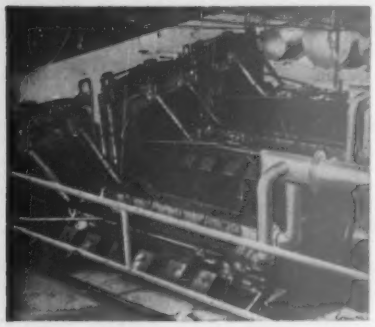
Oil Well Supply Division of United States Steel

USS

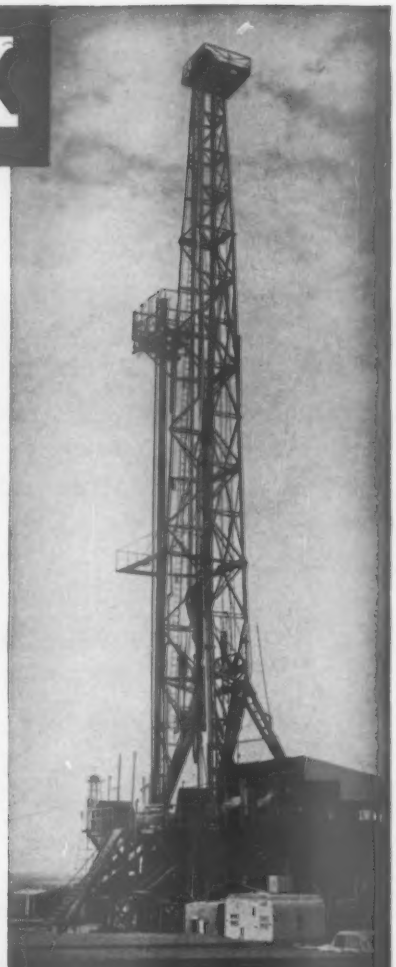
Executive and Export Offices: Dallas Texas

it's CLIMAX

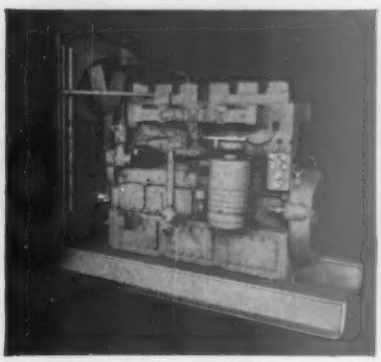
for DRILLING and PUMPING



● Climax Engines have proven their reliability in hundreds of oil field installations. Single, well balanced design, rugged construction, and quality materials make them smooth running . . . for years!

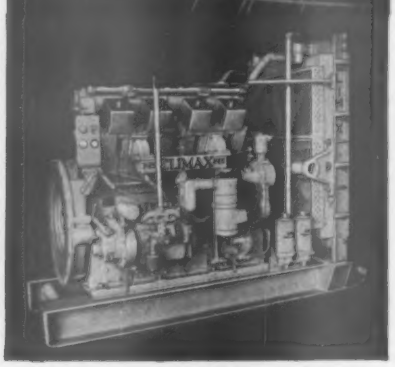


for COMPRESSORS



Model K-67—Max. hp 265 (Natural Gas)

Model V-125—Max. hp 605 (Natural Gas)



Model V-85—Max. hp 390 (Natural Gas)

CL-116-R

CONT. DUTY (NAT. GAS) →			DRILLING-PUMPING (80% RATINGS)						COMPRESSORS (65% RATINGS)				
Model	Bore & Stroke	Displ.	Peak Torque @ RPM	Brake hp at Speeds Indicated					Peak Torque @ RPM	Brake hp at Speeds Indicated			
				600	800	900	1000	1100		800	900	1000	1100
V-65	6½ x 7	1238	684 @ 750	81	105	117	127	135	557 @ 800	85	95	103	108
K-67	7 x 7	1616	955 @ 850	110	145	161	176	188	775 @ 800	118	131	143	149
V-75	7½ x 7	1855	1090 @ 800	126	166	185	204	218	885 @ 800	135	151	166	174
V-80	7 x 7	2155	1240 @ 850	140	188	210	230	246	1002 @ 800	153	171	187	194
V-85	7½ x 7	2474	1460 @ 800	164	223	246	266	284	1185 @ 800	181	200	216	222
V-122	7 x 7	3232	1920 @ 800	217	293	328	353	378	1562 @ 800	238	265	288	300
V-125	7½ x 7	3711	2240 @ 850	242	340	384	417	442	1820 @ 900	276	312	340	354

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY

FACTORY—CLINTON, IOWA

Oilfield Pipes

are inseparably connected with the development of the petroleum industry. For decades, PHOENIX-RHEINROHR has essentially contributed to the achievements made in the drilling technique by furnishing standardised API steels and special steels as well as high-strength joints. Our

Drill Pipe
Casings
Tubing and
Line Pipe

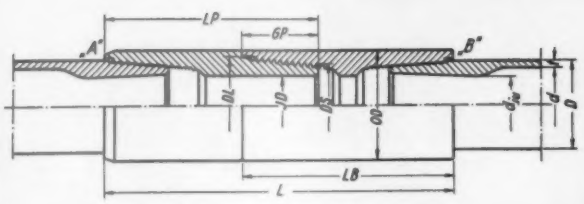
afford maximum operating safety.

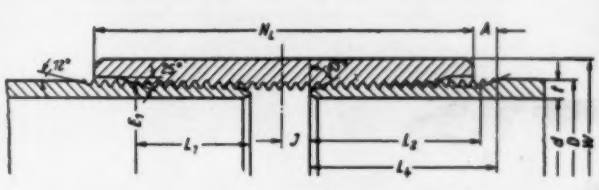
We are privileged to use the API monogram.

PHOENIX-RHEINROHR AG

VEREINIGTE HUTTEN- UND RÖHRENWERKE DUSSELDORF

GERMANY

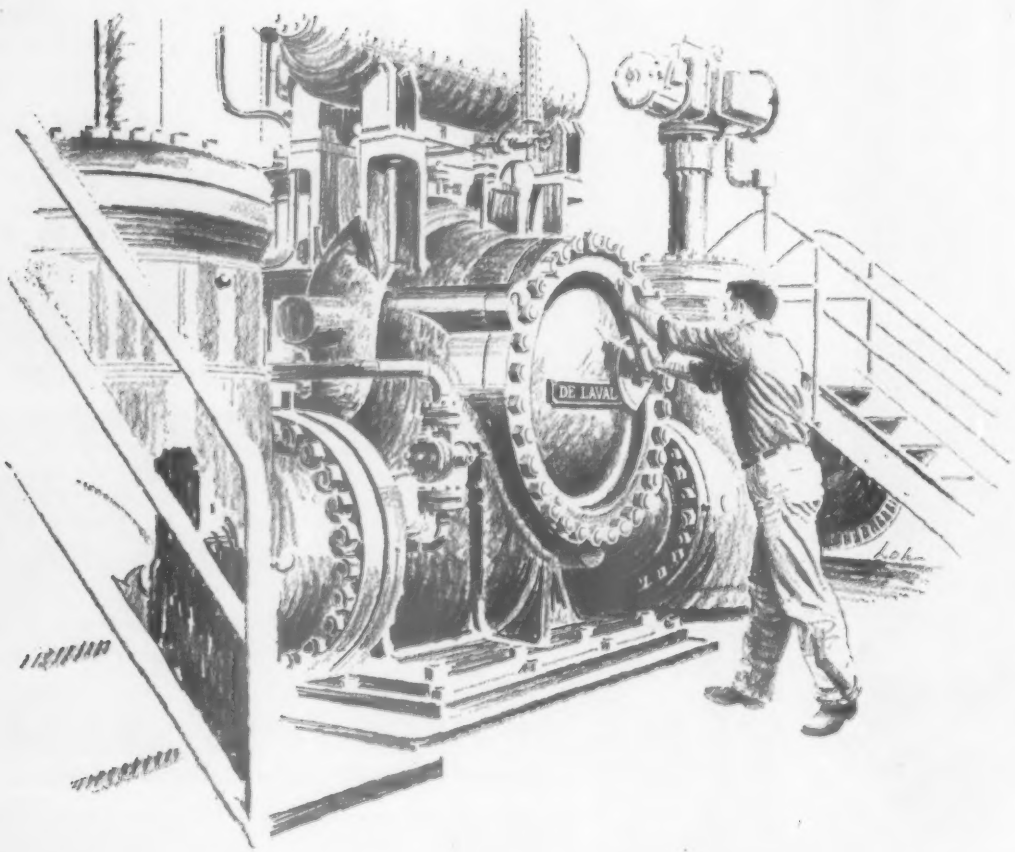




DE LAVAL
engineered
flexibility
gives more flow
as pipelines grow

De Laval centrifugal compressors that boost gas through pipelines are a good example of De Laval engineered flexibility. Just two changes in parts — impellers and diffusers — increase compressor capacities and pressure ratios. Fluid flow keeps in economical step with growing demand.

Many companies face problems caused by fluctuating production levels, variable or interrupted operations, steady or rapid growth. To help solve such problems, De Laval engineers maximum flexibility into all of the many products it furnishes to industry.
De Laval Steam Turbine Co., Trenton 2, New Jersey.



MG-DL-100

DE LAVAL • 60 YEARS OF CREATIVITY AND QUALITY

CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

FOR YOUR WETTEST JOBS

Wagner® Silicone Rubber Insulated Motors

Power-packed drip-proof polyphase motors that are exceptionally moisture-resistant . . . save you money in lower initial equipment cost for many applications

These are motors that are built to take on and tame the toughest jobs. Big, job-rated motors, available in frames larger than 445U, through 1000 horsepower. Perfect drives that can be used for station auxiliaries, in chemical plants, in rubber and paper mills and in the petroleum industry.

With motor coils completely sealed in a jacket of silicone rubber and housed in a compact, drip-proof enclosure, these Wagner® motors are suitable for use in highly humid atmospheres. They perform perfectly even after long exposure, and at elevated temperatures. Since moisture does not penetrate their tough silicone jackets, they are now used for many installations that once required totally-enclosed motors. Silicone rubber insulated motors cost less to buy than equivalent totally-enclosed fan cooled motors, since there is no need for expensive enclosures.

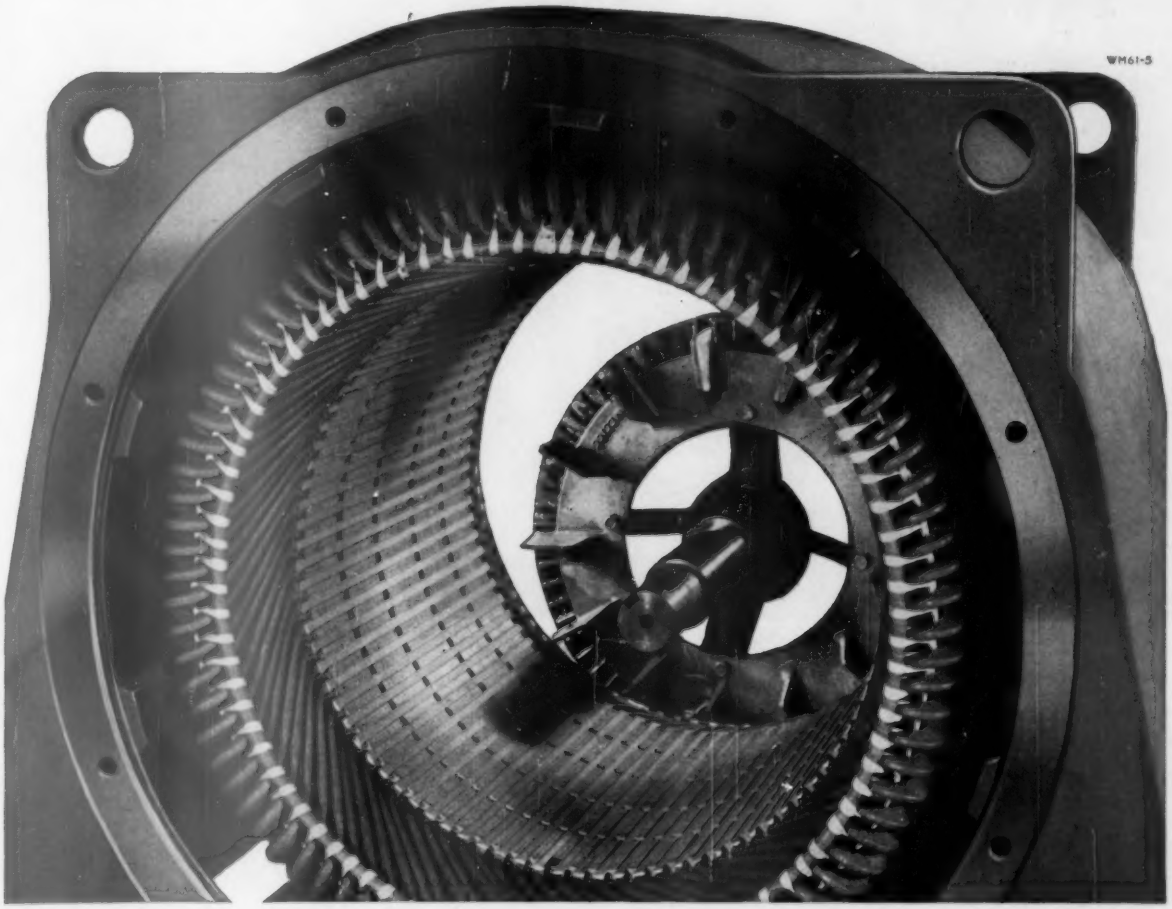
But your savings don't stop with initial cost. When rated to match normal load, Wagner silicone rubber insulated motors deliver rated horsepower at top efficiency. They have more overload capacity for temporary overloads . . . reduce downtime while they help keep production levels up.

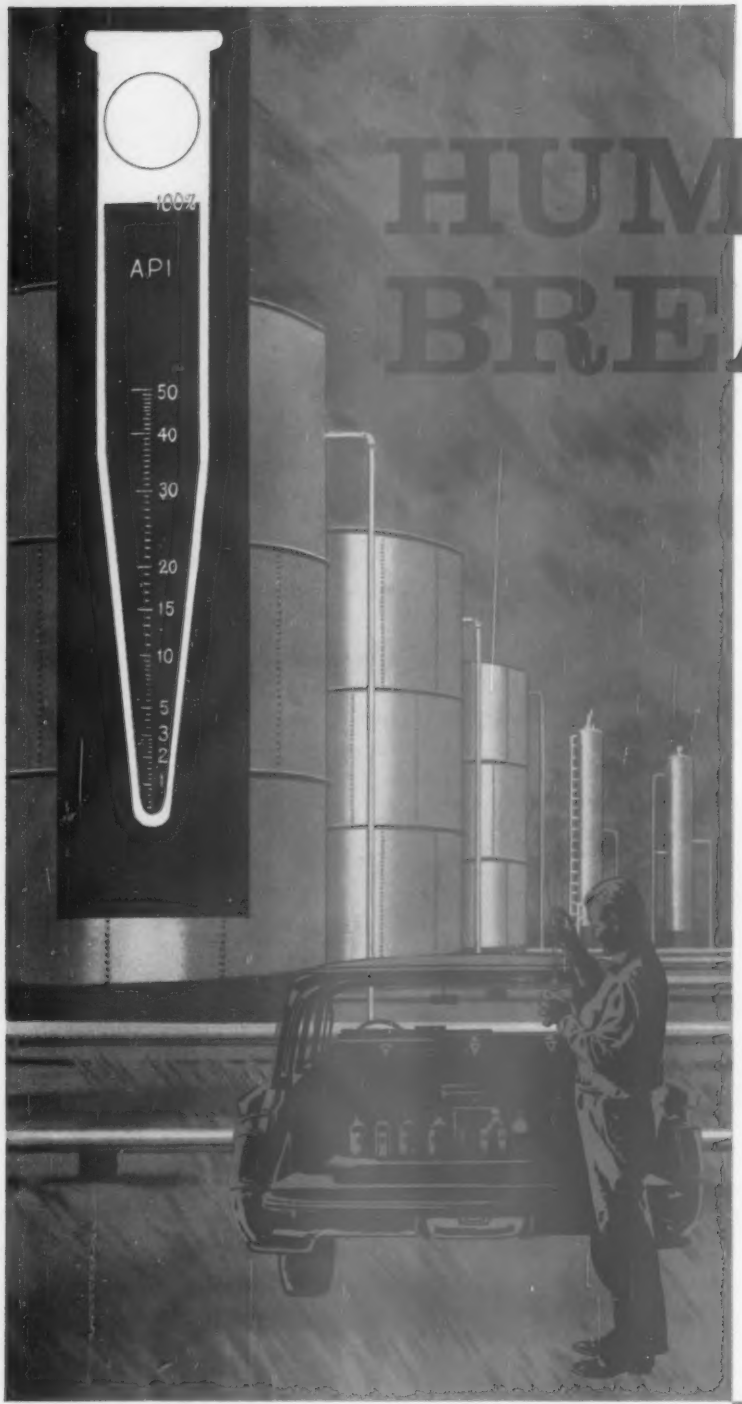
Like to hear the whole money-saving story of these dependable Wagner silicone rubber insulated motors? Call your Wagner Sales Engineer . . . then settle back for some profitable listening.

Wagner Electric Corporation

6389 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.

WM61-5





HUMBLE BREAXIT®

Gets maximum pipeline oil from any well

To get the greatest amount of salable oil from your production, there are many *different* Humble BREAXIT emulsion breakers . . . each designed for efficient treatment of a different concentration of water in the oil. Result?

Users of these specialized BREAXIT formulations report important savings through lowered treating costs and increased recovery.

Find out which BREAXIT will be most profitable in your production. Ask Humble to have its engineers make on-the-lease tests of your emulsions. For more information about BREAXIT, see your Humble salesman, or contact Humble Oil & Refining Company, Houston, Texas.

HUMBLE OIL & REFINING CO.

America's Leading ENergy COmpany

ENCO PRODUCTS

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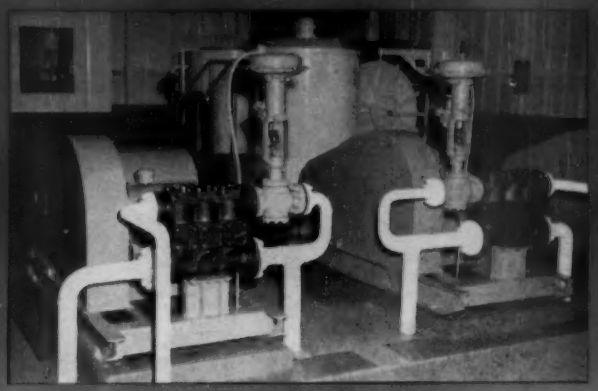
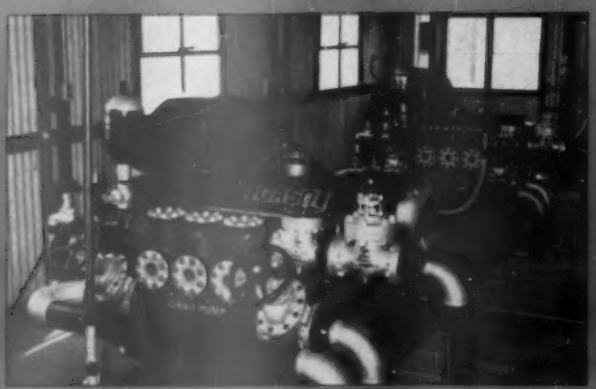
WHY YOU CAN LOOK TO THE LEADER FOR TOP PERFORMANCE IN

WATER FLOOD SERVICE

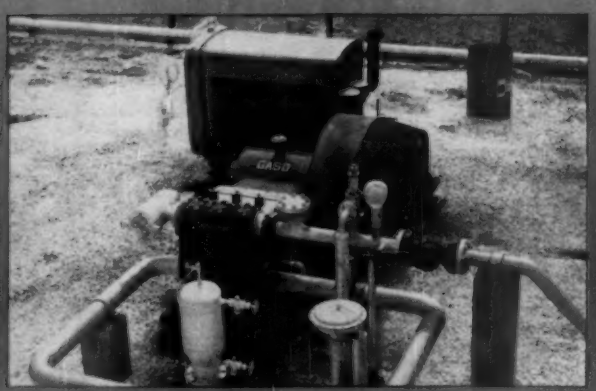
Fig. 3364 Gaso Horizontal Triplex Pump with ceramic plungers, aluminum bronze fluid end and Monel Valve assemblies, powered by 20 HP electric motor. Capacity, 850 BPD at pressures up to 1200 p.s.i.



Operating at 350 RPM, each of the three injection pumps in this installation (Gaso Fig. 3365 Horizontal Triplex Plunger pumps) delivers 1075 barrels per day at 1500 pounds discharge pressure.



Only service required on this Gaso Fig. 3466 Horizontal Triplex Plunger pump in discharging 1½ million barrels of salt water was the replacement of the plungers — at a total cost of $73.89.



Whatever the need, you may depend on Gaso for pumps and fittings best suited to the conditions. Illustration shows a Gaso Fig. 3671 Pump [illegible]alt water disposal service in Louisiana.

Where else but from the leader can you buy pumps embodying so much experience, so many advances and refinements, such demonstrated operational efficiency and maintenance economy? Where else can you find so complete a line and such cooperative pump service specialists as Gaso distributors? When the selection of pumps is governed by the yardstick of value, the logical choice is GASO Pumps. Our engineers welcome the privilege of applying their specialized experience to any problem involving water flood pumping service.

GASO PUMPS
for every oil industry need

GASO PUMP & BURNER MFG. CO.
FIRST and LANSING STS., TULSA, OKLAHOMA
EXPORT OFFICE: 2712 EMPIRE STATE BLDG.
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Farmington, N. M. – Gaso Pump & Burner Mfg. Co. • Shreveport, La., Odessa, Texas, Brookhaven and Tinsley, Miss. – W. L. Somner Company • Houston, Texas – Texas Pump & Compressor Company • Wichita Falls, Texas – Pump Engineering Co. • Evansville, Ind. – Hague Equipment Co., Inc. • Long Beach and Bakersfield, Cal. – Power Pumps, Inc. • Casper, Wyoming – Lufkin Foundry & Machine Co. • Jackson, Mich. – Midway Supply Co. • Edmonton, Alberta – Lufkin Machine Co., Ltd.

Looking in on . . .

fast mud mixing

This is what a large number of mud tanks look like on drilling barges all up and down the coast.

The powerful mud flow that's created here comes from the two big turbine impellers on this LIGHTNIN Mixer. It represents your best way to get fast mud mixing.

Change mud in seconds

When you mix with LIGHTNIN Mixers, you can actually increase the weight of every gallon of mud in the tank by the exact amount you want in *a few seconds.*

Just add weight and gel to the mud through a high-speed LIGHTNIN Flash Mixer and you get an immediate rise through the whole system. Within a few minutes, weight and viscosity are completely equalized.

See for yourself

Ask your LIGHTNIN sales engineer or supply company representative to show you a nearby rig where LIGHTNINS are at work. He'll arrange a field trip to a barge or land rig in your area.

You'll find his name listed in the Composite Catalog. Contact him today—or write us direct.

MIXING EQUIPMENT Co., Inc.
174-h Mt. Read Blvd., Rochester 3, N. Y.
In Canada: Greey Mixing Equipment, Ltd.
100 Miranda Avenue, Toronto 19, Ont.
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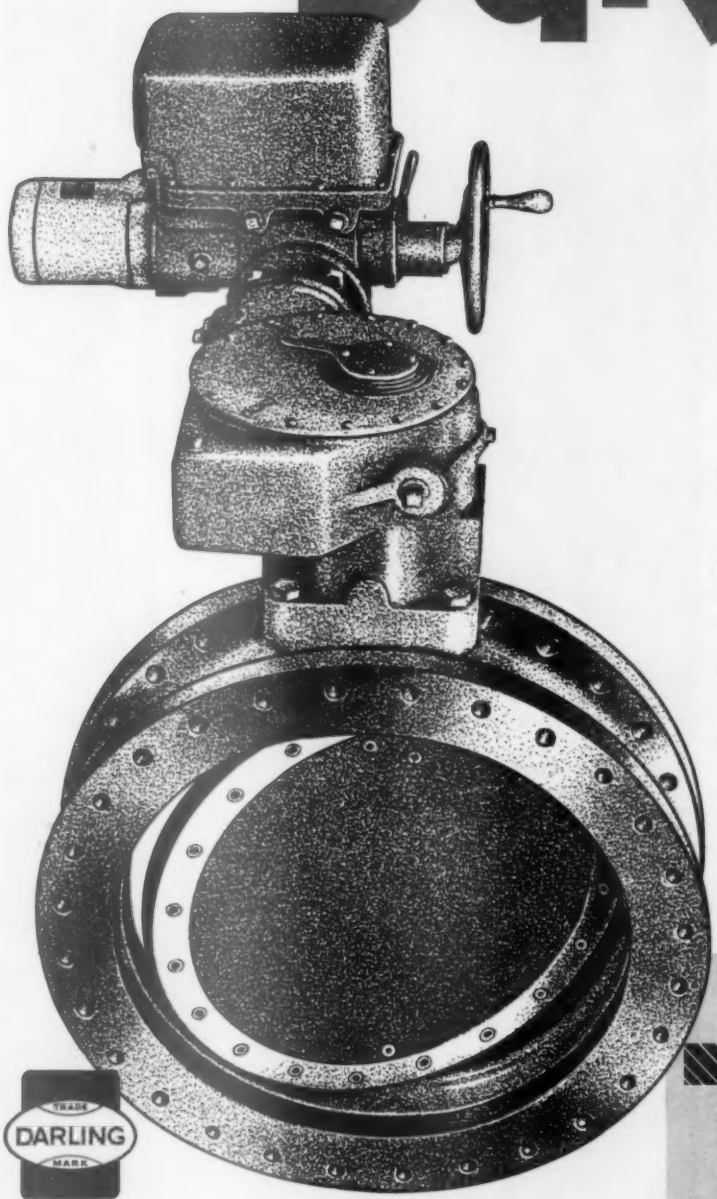
Lightnin® Mixers
MIXCO fluid mixing specialists

YOU CAN DEPEND ON

Darling



***drop-tight* shutoff**
***maximum* seat life**
***easy* operation**

Darling-Pelton Butterfly Valves have a continuous 360° rubber sealing ring, uninterrupted by the valve shaft, that makes complete drop-tight shutoff possible. The valve disc, swinging on an axis eccentric to the valve centerline, is exceptionally easy to operate. It lifts away from the body seat on opening to eliminate any abrasion or distortion. The rubber seat can be replaced quickly without dismantling the valve. *You can depend on* Darling-Pelton Butterfly Valves for safety, long service, superior performance.

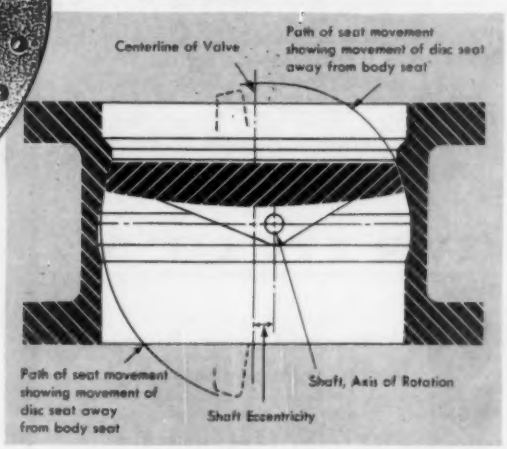
Write, wire or phone for your copy of Bulletin 5904 giving complete information on these butterfly valves made to A.W.W.A. Specifications.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario, Canada
Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France

GATE • BUTTERFLY • CHECK • SPECIAL VALVES • FIRE HYDRANTS

Exaggerated diagram showing eccentricity of valve shaft in relation to valve axis and how the disc, upon opening, is lifted from the body seat throughout its entire circumference.


Centerline of Valve
Path of seat movement showing movement of disc seat away from body seat
Path of seat movement showing movement of disc seat away from body seat
Shaft, Axis of Rotation
Shaft Eccentricity

Trinity
LITE-WATE

A Complete Low Density Cement with

EXCEPTIONAL COMPRESSIVE STRENGTH

Strength is recognized as one of the important qualities of an oil well cement slurry. TRINITY LITE-WATE cement develops exceptional compressive strengths.

In the range of lightweight cement slurries, TRINITY LITE-WATE produces a slurry which is:

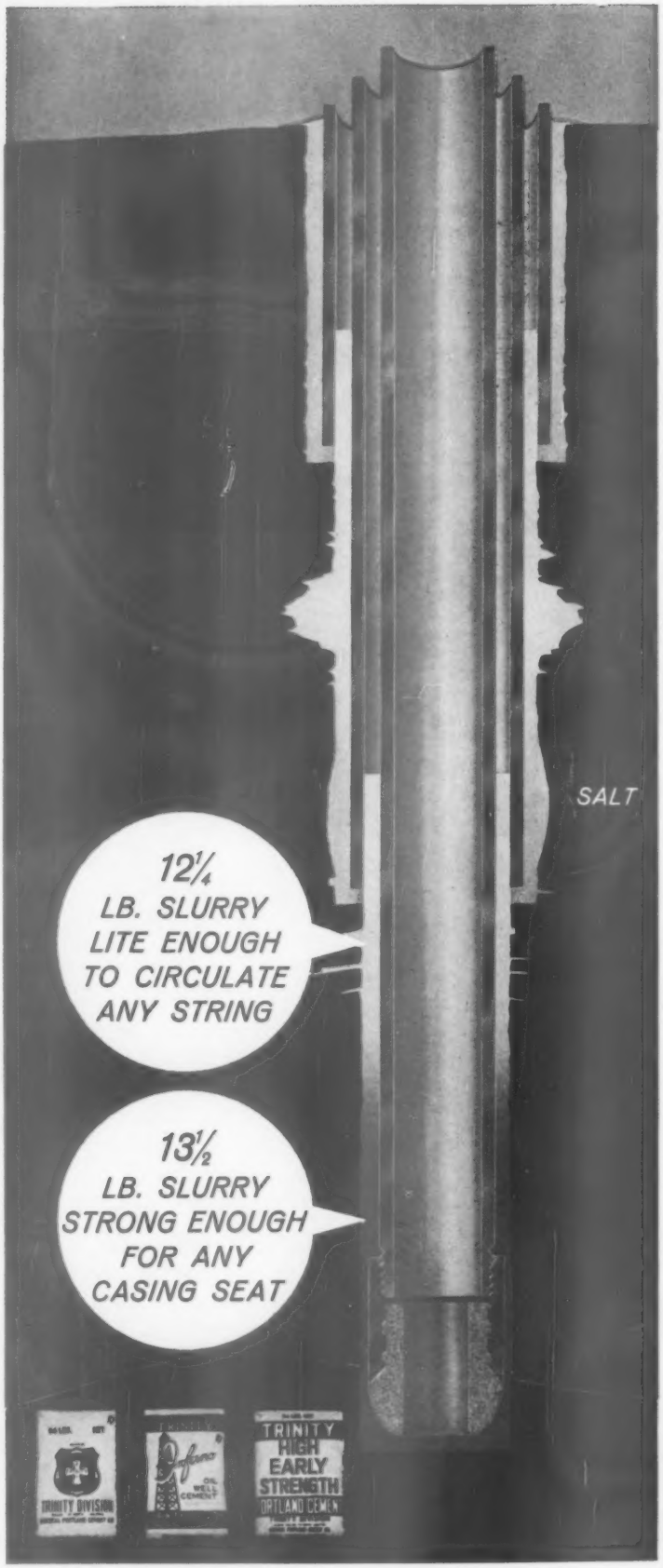
1. Light enough to circulate.
2. Strong enough for any casing seat.
3. Strong enough to permit hydraulic fracturing.
4. Impervious to migrating fluids.
5. Sulfate resistant for lasting casing protection.

For TRINITY LITE-WATE cement call your service company.

For complete Laboratory Data call your local Trinity Representative or write Dallas Office, P. O. Box 2698 or phone RIverside 2-8111.

376 lb. Barrel 94 lb. Sack

75 lb. Dry Volume per cubic foot


SALT
12¼ LB. SLURRY LITE ENOUGH TO CIRCULATE ANY STRING
13½ LB. SLURRY STRONG ENOUGH FOR ANY CASING SEAT
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Trinity
TRINITY HIGH EARLY STRENGTH PORTLAND CEMENT

TRINITY

PORTLAND CEMENT DIVISION
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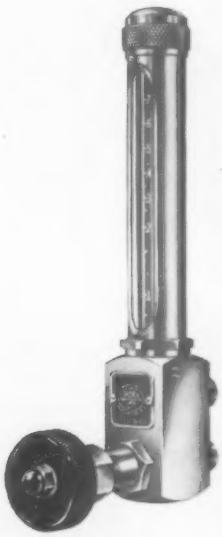
DALLAS·FT.WORTH·HOUSTON

HOKE Flow Sheet 6

HOKE REPORTS ON FLUID CONTROL

MEASURING, METERING AND DO-IT-YOURSELF



FLOW WATCHING FOR FUN AND PROFIT

(Follow the bouncing ball)

After making flo-gages for longer than we'd like to remember, we've come to realize that there's no one simple answer to the problems of flow measurement. Rather than try to solve everyone's problems at once, we've concentrated our efforts in the low, but delicate, flow ranges.

The variable area principle (the ball float in tapered tube bit) is nothing new, and we haven't done much to advance science here. But what we have done is to build some direct reading flo-gages that provide pretty accurate pictures of the downstream activities of some of your favorite gases. Depending on the gas you're using, we've made units with maximum ranges from 0.7 liters per minute up to 44 cubic feet per hour, and we've even built a needle valve into one unit for fussy flow watchers.

Serious hydrodynamicists (flow watchers, to you) will be happy to hear that they can get Hoke flo-gages in straight, angle and panel mounting models.

For a guide to flow-watching, make your mark in the box on the right.

One good turn deserves another, and it takes twenty to move the stem of the Hoke 280 Series metering valve from the closed to the full open position — a total of 9/16". And in case you lose count (or can't count) we can supply it with a vernier handle that shows turns and fractions of turns for accurate re-set.

What you're moving when you twirl the wheel on this bar stock needle valve is really a needle. It has an 8° included angle and seats in either a .062 or .125 orifice, so you can see it's possible to turn down to a pretty accurate trickle. If an 8° included angle will still not give you the control you want, we've turned stems that read out to a 1° included angle.

Now, here's a real stopper—a Teflon seat. In this modification, the needle is spring-loaded so that it can't gall, or be scored. And it's backed by a Teflon seat for positive shut-off. This seat bottoms on a raised orifice in the valve body and can be used to hold pressures up to 3000 psi. Vacuum's a snap, too.

If these facts leave you still unmoved, we've got a few more gems to dazzle you with. For instance, you can use these valves to temperatures up to 450°F. And you can choose from brass or 316 stainless steel.

And if you're one of those people who must be different, why not build one yourself. It's easy and you can do it by reading our 280 Series Data Sheet. All you need is a screw machine, turret lathe, milling machine and a few other easily acquired gadgets. However, if things don't work out too well, you can still get them from us.

To be really knowledgeable in the field of fine metering, all you have to do is read the facts in the Data Sheet. A check in the 280 box will bring you instant information.

'61 PRODUCT PARADE

You'd be surprised at some of the screwball ways our valves have been used (to decided advantage, of course). Hoke distributors are armed to their maxillary third molars with this method madness and will redesign your systems with new Hoke products at the drop of a postcard. Check the PRODUCT PARADE Box.

Hoke's Performance Guarantee—*Every Valve Leak-Tested!*

HOKE INCORPORATED
63 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ 280 Series Metering Valves
- ☐ Flo-gages
- ☐ '61 Product Parade
- ☐ Complete Catalog GC 960

NAME_____ TITLE_____

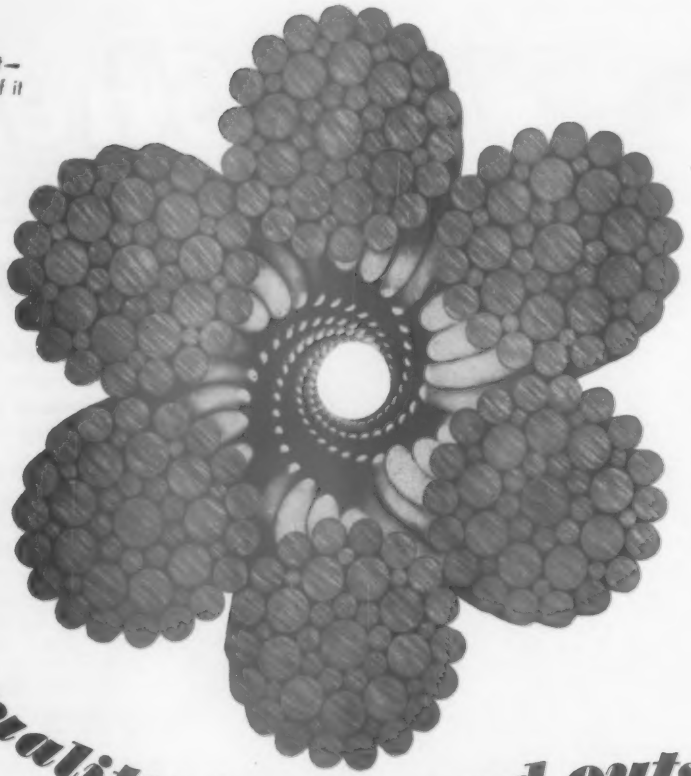
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

SEE OUR CATALOG IN SWEETS PRODUCT DESIGN FILE

We put a lot of work into it—
You get a lot of work out of it



Quality inside and outside

Two important angles on wire rope savings: the *quality* and *uniformity* Roebling builds all the way through Royal Blue Wire Rope. They give you a big, extra margin of service through every kind of wear and tear — and combine to make extra strong Roebling Royal Blue the toughest wire rope you can buy. Find out more from your wire rope distributor, or write for free booklet to Roebling's Wire Rope Division, Trenton 2, N. J.

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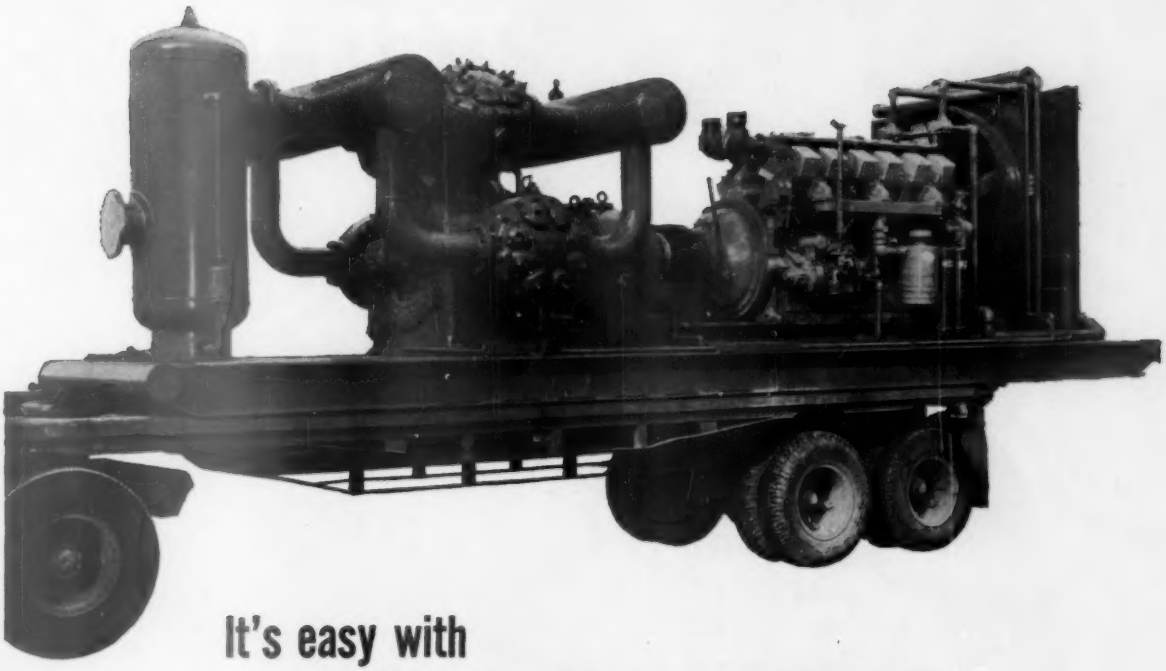
Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corp.

CHANGE CAPACITY
CHANGE LOCATION



It's easy with
JOY GAS BOOSTERS

Joy packaged gas boosters are completely flexible. The complete unit on the skid is well within the allowable size limits for over-the-road hauling to permit easy change of location. Flexibility to match varying conditions in the well is provided by Joy's replaceable cylinder liners, which can be changed to vary compressor capacity. For wide fluctuations in well conditions, the entire cylinder assembly can be changed—any Joy cylinder fits every Joy compressor.

For gas boosting units rugged enough to stand up under the severe service conditions, and flexible enough to meet any operating requirements in the field, consult your Joy fabricator. He has a complete range of sizes from 50 to 400 hp—up to 7400 cfm.

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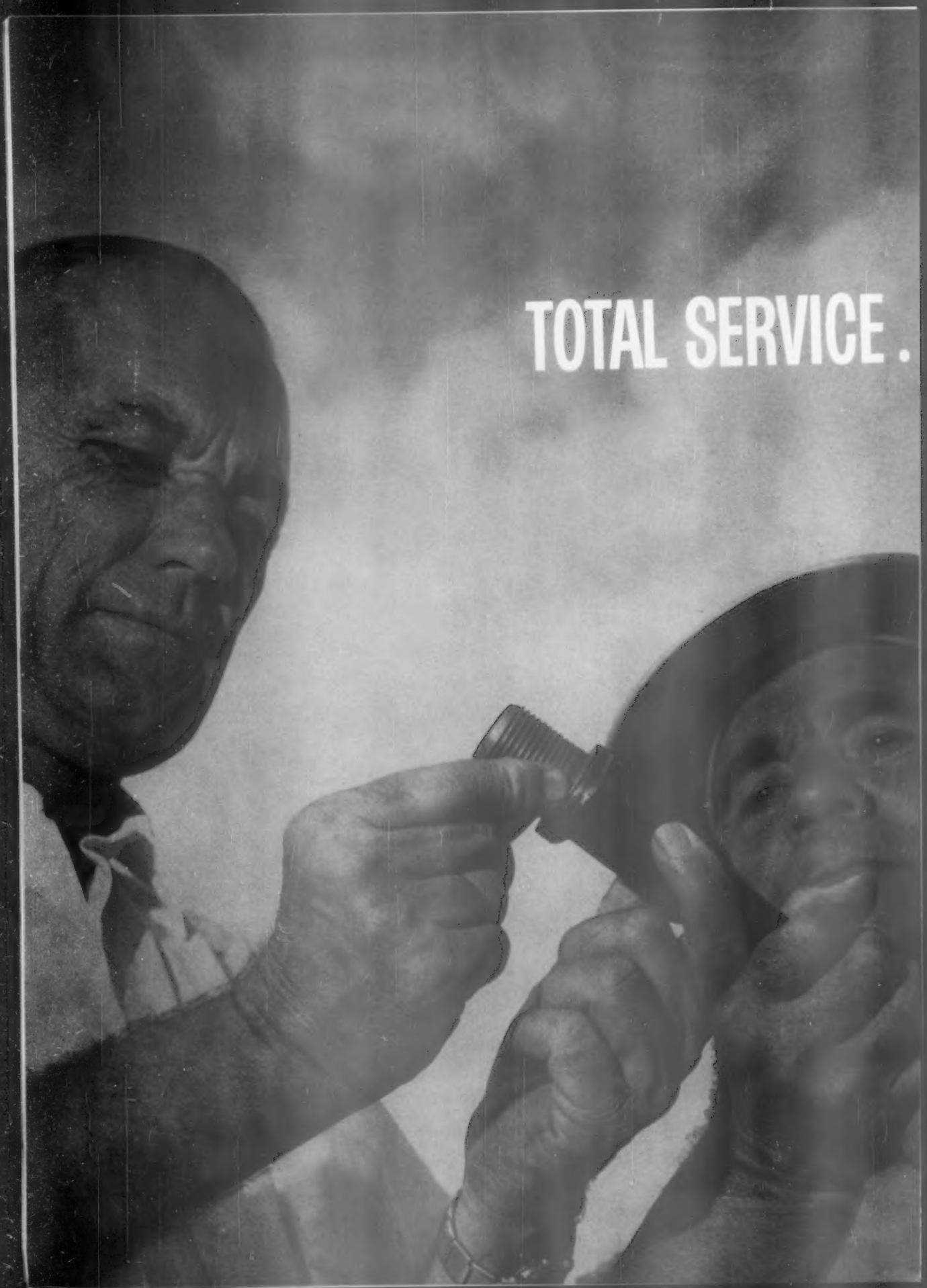
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Continental-Emsco gives you service when and where you need it! Whether it's checking sub-surface equipment performance . . developing specialized equipment for overseas operations . . or carrying out full lease development programs . . Continental lowers your operating costs. Further, you can count on immediate availability of spare parts and men during emergencies and continuous maintenance for equipment you've had in operation for years! This is the competent service you expect! It's TOTAL service . . and Continental's got it . . worldwide!

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ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

CAN YOU PICK THE RINGS WITH 37,000 HOURS' WEAR?

UNRETOUCHED PHOTOGRAPH

Take a close look at this engine piston that's just been pulled for routine inspection at the generating plant of Illinois Rural Electric Co. Then see if you can pick the rings with 37,000 hours of wear.

No matter which ones you picked, you're right! The *complete set* of Cook rings has completed 37,000 hours of operation. But you wouldn't know it.

What's the reason for the unusual wearing qualities of this set? Special, expensive *top* rings? No, they're standard Cook sealing rings. The reason is to be found in grooves number 4 and 5 — COOKTITE sealing rings. Cooktite rings completely seal the ring gap, ring groove, and cylinder wall, and greatly reduce the excessive load normally carried by ring number 1.

Maybe Cooktite is the solution to your ring problem.

HAVING TOP RING TROUBLE?

If you have had trouble with your top piston rings (excessive groove wear, groove damage, ring breakage, etc.) you won't need to be convinced that the top ring carries from 50 to 80% of the sealing load. The solution that is saving dollars for many companies is the installation of a Cooktite sealing ring, or rings, in the lower grooves.

In an engine with a compression pressure of 500 psi and a firing pressure of 1,000 psi, a Cooktite ring will reduce the pressure differential on the top ring from a trouble-causing 750 psi to an easily-handled 500 psi. Ask a Cook representative to show you where Cooktite rings can work for you.

SEND FOR FREE 8-PAGE BOOKLET

Improve your engine's performance and keep it high for longer periods by better cylinder sealing. You can get a free copy of this informative technical study by writing C. Lee Cook Division, Dover Corporation, 934 South 8th St., Louisville 3, Kentucky.

C. LEE COOK

DIVISION OF DOVER CORPORATION

Rings and Packings Since 1888

Uncoiling 1¼-inch pipe made of MARLEX during the recent installation by North Carolina Natural Gas Corporation, Fayetteville, N. C. This 400-foot coil of tough, lightweight plastic pipe is easily handled by two men. The MARLEX pipe for this job was supplied by Glamorgan Plastics, a division of Glamorgan Pipe and Foundry Co., Lynchburg, Va.

North Carolina Natural Gas Corp. switches to tough, non-corroding pipe made of MARLEX*

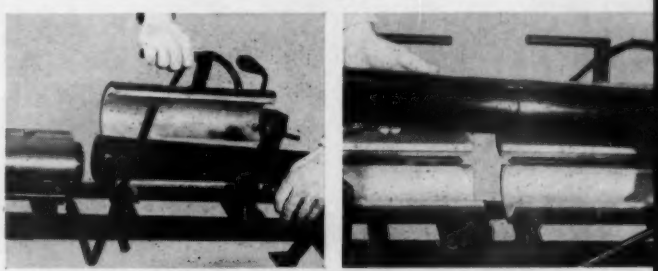
Their first "trial installation" was some 3,000 feet for natural gas distribution to farm homes and tobacco curing barns near Goldsboro, N. C. Taking-off from a transmission line, 1¼-inch MARLEX pipe was used for distribution. Service lines to farm homes and barns were ¾-inch MARLEX pipe.

Mr. Bob Wiseman, District Superintendent at Goldsboro says, "We have used other plastic pipe, but as a result of this successful trial, we have switched to MARLEX pipe and are now installing an additional 50,000 feet . . . and more installations are in the planning stage. It's rugged, durable, low-cost pipe . . . lightweight, easily handled and very economical to install. We use steel compression couplings and fittings because we have long runs with very few joints."

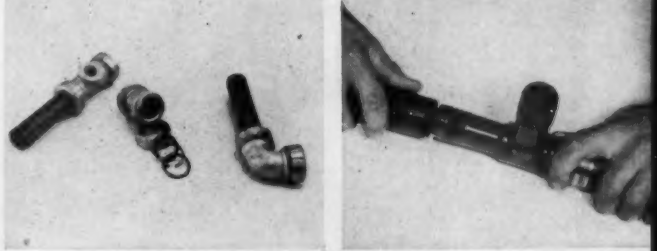
North Carolina Natural Gas Corp. is one of an increasing number of gas utilities choosing pipe made of MARLEX high density polyethylene . . . for new direct-buried installations, or for inserting in old mains and services. Available in sizes from ½ inch through 10 inches in coilable and straight lengths, pipe made from MARLEX TR-212 (ASTM Type III polyethylene) has been thoroughly field-tested for natural gas service. It's virtually indestructible . . . resistant to solvents, acids, alkalies, oils, bacteria, rot and fungi. Weighing about ⅛ as much as equivalent steel pipe, it's easy to ship and handle . . . can be economically installed without heavy equipment.

*MARLEX is a trademark for Phillips family of olefin polymers.

With MARLEX . . . proven, economical joining reduces installation costs.



BUTT-FUSION—Clamp in portable rig, heat ends, and join. Joint is stronger than pipe. Foolproof! Quick! Simple! Very economical, especially for 2" and larger sizes.



FITTINGS AND COUPLINGS—Many varieties available. Butt-fusion tee's, elbows and reducers made of MARLEX . . . or standard metal compression fittings.

For more information, see your pipe supplier . . . or contract us.

PHILLIPS CHEMICAL COMPANY
Bartlesville, Oklahoma
A subsidiary of Phillips Petroleum Company

PHILLIPS 66 MARLEX PLASTICS

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WITH NO MAINTENANCE
NO LUBRICATION
GROVE VALVES

Whatever the completion: single, dual, triple; whatever the service: master, wing or flow line; wherever the location: prairie, swamp or platform, Grove production valves serve you best. Designed and proved in highest pressure wells, Grove production valves offer exclusive "double-barrier" seal. First—positive metal-to-metal seal between inner seat rings and parallel sided gate; second—protected o-rings that seal and squeegee the gate clean and smooth for fast, easy open and close. For master valve service: Grove standard G-2, Balanced Stem, Dual Block, Recessed Body valves and compact Grove Valv-Pak. For wing valves: G-2's and new compact G-6's. Grove V-2's, VL-2's for flow line service. Don't just look at the selling price! Investigate how Grove production valves eliminate maintenance and lubrication costs!

GROVE PRODUCTION VALVES

GROVE VALVE AND REGULATOR COMPANY

a subsidiary of Walworth

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New low-cost accelerator for secondary oil recovery!

Extensive laboratory tests and successful field applications have proved that PETROFOS greatly improves injection rate of waterfloods—*at low cost.*

At the water plant, a PETROFOS fresh-water solution is prepared—and then simply metered into the injection stream.

RESULTS? PETROFOS promotes wetting of reservoir surfaces by the treated floodwater—speeding up displacement of oil. With the same (*or even reduced!*) wellhead pressure, use of PETROFOS sharply increases both your water injectivity and oil-recovery rates. Flooding time shortens—assuring big operational savings.

PETROFOS field applications with a variety of well formations and injection waters have produced substantial injectivity increases.

TYPICAL APPLICATION (Bartlesville sand formation)		Average Water Injectivity (barrels per day/psi)
Before Treatment	August 1959	0.50
After Adding PETROFOS	December 1959	0.78
	May 1960	0.82
	September 1960	0.91

COST? Negligible—compared to savings that result. PETROFOS treatment in applications to date ranges from *only 5¢ to 20¢ per 100 barrels of water!*

WANT MORE FACTS? We'll be pleased to send you application and cost details outlined in our *Technical Bulletin 219.*

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They Say—

Pan Am—first with benzene

Dear Sir:

The Oil and Gas Journal of July 3, p. 92 (Processing Briefs) carried an item to the effect that Shell Oil Co. produced the first commercial petroleum benzene in 1947.

This statement is believed to be not in accordance with the facts.

My recollection is that Shell Oil Co. did produce two or three tank cars of petroleum benzene in early 1947. This operation, however, was experimental and not a commercial one. It is my information that this benzene was shipped to Monsanto Chemical Co. at Texas City and was subsequently destroyed in the Texas City disaster in the spring of 1947.

The first commercial production of benzene from petroleum was begun by Pan American Chemical Division of Pan American Refining Corp. (now a part of Amoco Chemicals Corp.) at Texas City in November 1949. All production went to Du Pont at Orange, Tex.

This operation continued without interruption until mid-1958. Shell Oil Co. began the commercial production of benzene in about April 1950 and is, thus, correctly the second such producer.

Frank J. Smith
Consulting Chemical Engineer
Scarsdale, N. Y.

Reader Smith is correct. Pan American's operation was first. It was conducted on a plant scale experimentally in the early spring of 1949 and resulted in commercial production of benzene on a regular basis beginning about December 1, 1949.—Ed.

Technical supply and demand

Dear Sir:

You are certainly to be commended for bringing such an important subject (Oil Faces a Shortage of Technical Talent, OGJ, June 19, p. 59) to the attention of the industry.

Under today's conditions it appears that approximately 7,800 petroleum engineers are needed for U. S. producing operations. Service companies require an estimated

How to save weight...space...cost with Gates Super HC Drive

Two types of V-belt drives were designed for this pump, used by Phillips Petroleum Co. in waterflooding operations at the South Burbank Field in Oklahoma. One was a Gates Super HC High Capacity V-Belt Drive. The other was a conventional V-belt drive.

This installation requires only ten 3V Gates Super HC V-belts to transmit power that would require 21 conventional B-section V-belts.

By installing the Gates Super HC Drive, Phillips reduced drive cost . . . saved 197 lbs. in drive weight . . . 74% in drive space . . . plus saving the cost of an outboard bearing that would have been necessary had the conventional V-belt drive been used.

All of these savings are the result of basic design changes that Gates has made in V-belt shape, construction and materials. Because of these changes, Gates Super HC V-Belts can handle up to 3 times the horsepower of conventional V-belts in the same space.

Many additional savings are possible: reduced bearing loads, longer bearing life . . . more compact guards and machine housings with lower material costs and weight . . . belt speeds up to 6,000 ft/min without dynamic balancing, often permitting use of lower cost, higher speed motors.

For expert drive design help, *and for complete technical service, contact your local Gates Man by calling your nearby Gates-stocked supply house.*

The Gates Rubber Company, Denver, Colorado BP56

Gates Super HC V-Belt Drives

2,200. This makes an approximate total of 10,000 engineers employed by the producing function.

The annual new graduate requirement must be of the order of 1,000. When it is recognized that a sizable number of chemical, mechanical and electrical engineers do continue to be attracted to the industry, it would appear that the demand for petroleum engineers might be of the order of 300-400 each year for the short term future.

If this admittedly rough analysis is a reasonable reflection of the outlook for petroleum engineers, it seems that the educators might well reappraise the situation and orient their aims toward a substantially lower graduate rate than we had in earlier years. At the same time, it appears that to maintain a graduate rate of the order indicated, effort is justified to halt the current downward trend in enrollment.

M. A. Wright
Executive Vice President
Standard Oil Co. (N. J.)

Dollar and cents decisions

Dear Sir:

Congratulations on your issue of July 31, particularly on Henry Ralph's "Journally Speaking" (p. 91), the editorial, "The Cause and Cure of Price Sickness" (p. 93), and the article on "Gasoline Prices Start Edging Back" (p. 97).

I agree with the editorial that it should be the prime responsibility of executives to see that their companies do not sell their products below cost.

"Journally Speaking" points out that even the "skid" station, operating on a self-serve basis from a gravel or mud driveway, with an investment of three to five thousand dollars' worth of equipment, has been able to influence the price in a large area, even though the sales at that station are three to four hundred gallons per day.

Surely someone must be missing on salesmanship if a fine group of major stations with millions spent for advertising and the extra services must be forced to meet the retail price of the "skid."

It has been said that many of the private branders who once bought from independent refiners are now buying from major companies, and some are even reputed to have price protection.

It could be that if the private brander in some instances becomes the price cutter, the major who sells to him and meets the price cut is really meeting himself.

On Page 82 ("They Say") you quote L. F. McCollum, president of Continental Oil Co., as saying "Today's oil finding decisions must be, above all else, economic decisions." Probably a lot of our marketing problems would be solved if top management would expand that statement to include the thought that "marketing decisions must be, above all else, economic decisions."

M. Lloyd Freese
Vice President
Bell Oil & Gas Co.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

AUGUST

20-22 North Dakota Oil and Gas Association, ninth annual meeting, Plainsman Hotel, Williston, N. D.

20-24 Asphalt Institute, international con-

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Undercutting the pin shank further increases fatigue resistance by eliminating the run-out thread and improving the elasticity of the joint.
Ask your Jones representative for further information on the "Triple Threat".
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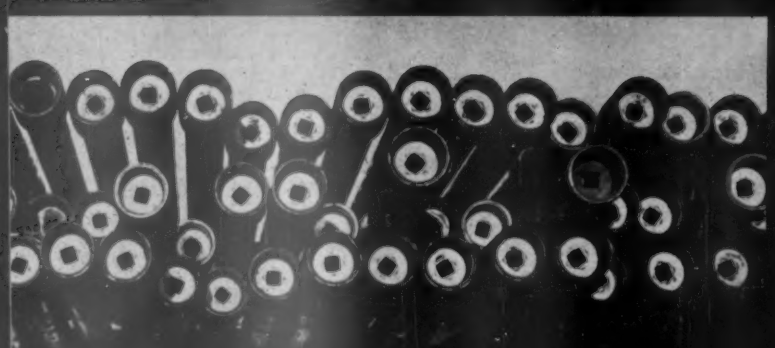

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ference on structural design of asphalt pavements, University of Michigan, Ann Harbor.

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference. Boulder, Colo.

SEPTEMBER

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-8 Rocky Mountain Association of Geologists, field conference, Salida, Monarch, Ouray, Silverton, and Durango, Colo., areas.

7-9 Magic Plains Oil Exposition, Borger, Tex.

7-9 Alberta Society of Petroleum Geologists and Geological Association of Canada, convention and field trip, Canadian sedimentary basins, Calgary.

11-15 Instrument Society of America, fall instrument-automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

12-13 American Gas Association, Southern Gas Association, annual accident prevention conference Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

13-15 National Northern Development Conference, "Canada's New Role in Resource Development," MacDonald Hotel, Edmonton.

14 Natural Gas Processors Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

18-20 Standards Engineers Society, tenth annual meeting Hotel Sherman, Chicago.

20-21 National Petroleum Refiners Association, Rocky Mountain regional meeting, Henning Hotel, Casper, Wyo.

20-21 American Institute of Electrical Engineers, Institute of Radio Engineers, Instrument Society of America, industrial electronics symposium, Bradford Hotel, Boston.

20-21 Ohio Petroleum Marketers Association, fall conference, Commodore Perry Hotel, Toledo.

20-22 National Association of Corrosion Engineers, Permian Basin section, annual West Texas corrosion tour, Lincoln Hotel, Odessa, Tex.

21-22 Air Pollution Control Association, east-central section, annual meeting, Sheraton-Seelbach Hotel, Louisville, Ky.

22-23 Association of Desk and Derrick Clubs, tenth annual meeting, Rice Hotel, Houston.

ORBIT FORGED STEEL PRODUCTION VALVES

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PLUS: *THESE ADDITIONAL FEATURES*

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WRITE FOR BULLETIN No. 400

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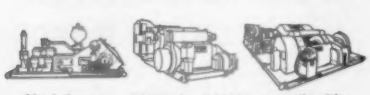

Slush Pumps 3000' to 25000' capacity Rigs

24-27 American Institute of Chemical Engineers, national meeting, Lake Placid Club, Lake Placid, N. Y.
24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.
25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.
25-28 American Welding Society, fall meeting, Adolphus Hotel, Dallas.

OCTOBER

1-4 American Gas Association, annual convention, Dallas.
3-4 University of Kansas, ninth annual gas measurement institute, National Guard Armory, Liberal, Kans.
4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.
4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.
4-6 American Society of Photogrammetry, semiannual convention and technical exhibit, Biltmore Hotel, New York.
8-11 Society of Petroleum Engineers of AIME, annual fall meeting, Memorial Auditorium, Dallas.
11-12 Western Petroleum Refiners Association, waste disposal and stream pollution conference, Hotel Lassen, Wichita.
12-13 California Natural Gasoline Association, annual fall meeting, Lafayette Hotel, Long Beach, Calif.
15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.
15-18 American Petroleum Credit Association, annual conference, Shamrock-Hilton Hotel, Houston.
17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.
18-20 Rocky Mountain Oil and Gas Association, annual conventon, Denver-Hilton Hotel, Denver.
18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.
19 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.
19-22 Louisiana Gulf Coast Oil Exposition, Lafayette, La.
24-25 University of Kansas, Southwest Kansas Center, pipeline institute, Court House, Liberal, Kans.
24-25 Pennsylvania Grade Crude Oil Association and Pennsylvania State University Mineral Industries Experiment Station, technical conference on oil recovery by solvents, Pennsylvania State University campus, University Park.
24-27 National Association of Corrosion Engineers, south-central region conference and exhibition, Shamrock-Hilton Hotel, Houston.
25-26 National Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.
25-27 Gulf Coast Association of Geological Societies, annual meeting, Granada Hotel, San Antonio, Tex.
27 Natural Gas Processors Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.
29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.
29- National Lubricating Grease Insti-

production and maintenance problems solved with Inhibited Acid

BEFORE CLEANING

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Dowell inhibited hydrochloric acid is an efficient, economical solvent and cleaning solution. It is low in cost when its cleaning capacity is considered. One hundred gallons of 15 per cent hydrochloric acid will dissolve up to 184 pounds (one cubic foot) of pure limestone or calcium carbonate. It is ideally-suited to do-it-yourself operations.

Dowell hydrochloric acid has many uses. Some of them are: to improve production from old dolomitic or limestone wells; to remove scale and "gyp" from the face of producing formations, tubing and lead lines; to clean disposal or input wells; and to descale engine cooling systems, heat exchangers, boilers, valves, fittings, nipples, etc.

Dowell inhibited hydrochloric acid is available in small or large quantities from any Dowell station. Ask a Dowell representative for application information.

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Improve your Engineering I.Q.*

* INCOME QUOTIENT

Train yourself and others in supervisory techniques for professional advancement

Popular thinking on any subject is often like a pendulum, swinging forward in sheer exhilaration over an exciting idea, then backward to a cynical attitude against it. Years ago, health columnists extolled the nutritive qualities of spinach. Shortly thereafter, it was equally popular to decry spinach as an overglamorized weed.

This vacillation springs from the efforts of spokesmen to capture interest, and the tendency of many people, like wild creatures in the forest, to give attention to whatever is moving regardless of the direction. That is why it sometimes seems that the more preposterous an idea the more credence it receives.

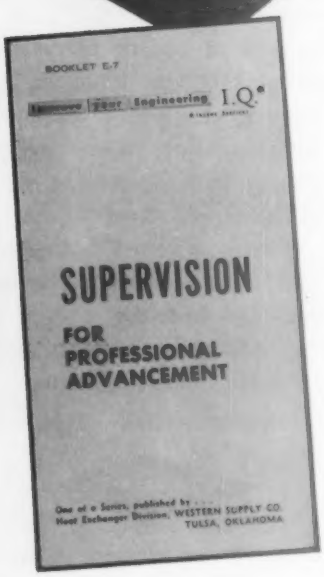
World War II, with its demands for hundreds of thousands of leaders to be developed quickly, accelerated the concept of training men in human relations. Many veterans tried, after the war, to apply the principles to industry. Supervisor and management development became extremely popular. Some of these programs naturally fell short of expectations, and there are always detractors — ready to display their intellectual brilliance by speaking cynically of *all* types of human relations training. Real progress in supervisory methods has, therefore, been slow.

Supervisory personnel, continually aware of the intrinsic values of human relations, are the key to uninterrupted production, completion of projects successfully and on time, for they forge the links in the productive chain solidly together.

Your management is interested not only in the creative, bold steps you would take into unknown solutions to problems, but also in how quickly and productively (profitably) you can put these ideas into practical application. When the solution, or idea, leaves your desk and starts down the long line of being put into practice, supervisors throughout that chain of action and their relationships with those about them — will determine to a great extent whether their individual components will function properly or whether a project will bog down under the weight of misunderstanding and apathy.

It signals to the engineer in charge, therefore, the importance of maintaining good supervisory practices throughout the various departments through which the original concept must be translated. It means a thorough understanding of human relations yourself, and the ability to communicate this understanding and appreciation to the supervisory personnel under you. This can and probably must be done both by individual contact with your supervisors and/or by conducting actual courses of study on the subject.

WRITE FOR YOUR COPY TODAY



. . . the foregoing paragraphs are a direct quotation from another of Western's personal-professional-development series, copies of which are available upon request at no charge. Western's conviction about the importance of competent supervisors as an adjunct to efficient engineering work is founded upon direct observation in our own plant, where trained supervisors contribute greatly to the manufacture of heat exchangers of the highest quality, and where personal attention to detail is their watchword. We invite your inquiry when heat transfer problems arise.

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HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P.O. Box 1888 – Tulsa, Oklahoma

Nov. 1 tute, annual meeting, Rice Hotel, Houston.

NOVEMBER

1-3 Southwest Federation of Geological Societies, annual meeting, Hilton Hotel, El Paso, Tex.
2-3 Society of Petroleum Engineers of AIME, annual California regional meeting, Hacienda Motel, Bakersfield, Calif.
2-4 Geological Society of America, annual meeting, Cincinnati, Ohio.
5-9 Society of Exploration Geophysicists, international meeting, Denver.
6-8 Chemical Institute of Canada, conference of the chemical engineering division, Royal York Hotel, Toronto.
9-10 Society of Automotive Engineers, national fuels and lubricants meeting, Shamrock-Hilton Hotel, Houston.
13-15 American Petroleum Institute, forty-first annual meeting, Conrad Hilton, Congress and Palmer House hotels, Chicago.
16 Illinois Oil and Gas Association, annual meeting, Mount Vernon, Ill.
17 Natural Gas Processors Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.
26-Dec. 1 American Society of Mechanical Engineers, winter annual meeting, Statler-Hilton Hotel, New York City.

DECEMBER

3-6 American Institute of Chemical Engineers, annual meeting, New Yorker Hotel, New York City.
4 AIME's Society of Petroleum Engineers, Arizona section, annual meeting, Pioneer Hotel, Tucson.
4-6 Interstate Oil Compact Commission, annual meeting, Denver Hilton Hotel, Denver.
5-6 National Petroleum Refiners Association, computer conference for refiners, Hotel Tulsa, Tulsa.

JANUARY

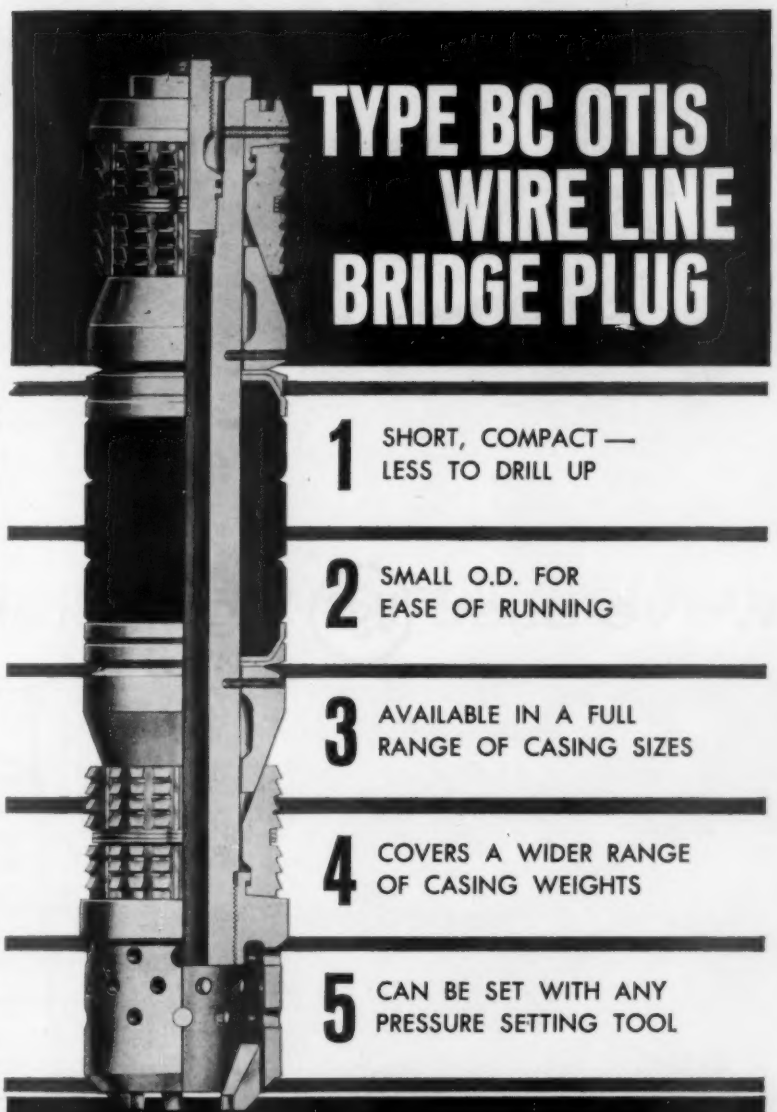
7-10 Pipe Line Contractors Association, annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.
8-12 Society of Automotive Engineers, annual meeting, Cobo Hall, Detroit.
16-18 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville, Ky.
19 Natural Gas Processors Association, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

FEBRUARY

4-7 American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles.
15-17 Southwestern Legal Foundation, annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.
18-22 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, New York City.
27-Mar. 2 International Oil and Gas Educational Center, institute on economics of the gas industry, Southwestern Legal Center, Dallas.
28-Mar. 2 American Petroleum Institute, Division of Production, southern district meeting, Rice Hotel, Houston.

MARCH

2 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.
16 Natural Gas Processors Association, Oklahoma regional meeting, Sheraton-Oklahoma Hotel, Oklahoma City.


TYPE BC OTIS
WIRE LINE
BRIDGE PLUG
1 SHORT, COMPACT — LESS TO DRILL UP
2 SMALL O.D. FOR EASE OF RUNNING
3 AVAILABLE IN A FULL RANGE OF CASING SIZES
4 COVERS A WIDER RANGE OF CASING WEIGHTS
5 CAN BE SET WITH ANY PRESSURE SETTING TOOL

Every time you specify the Type BC Otis Wire Line Bridge Plug, you get 5 plus features designed to help you take the guesswork out of your plugging operations—and yet the plug costs you no more than an ordinary plug. For this reason, many operators have standardized on the Type BC. They found they could successfully run the Type BC where other plugs failed to get down. In addition to the 5 big advantages you get with a Type BC Bridge Plug, you will find it's available from leading electric line service companies and stocked in over 200 different field locations — wherever you need it. Take the guesswork out of your plugging operations — the next time you need a bridge plug, specify Otis.

Type BC Otis Wire Line Bridge Plugs are available in these sizes:

SIZES	CASING WEIGHTS	SIZES	CASING WEIGHTS
2⅞"	6.4 — 8.6 lb.	5½"	13 — 20 Lb.
4½"	11.6 — 15.1 Lb.	6⅝"	17 — 24 Lb.
4½"	9.5 Lb.	7"	20 — 38 Lb.
5"	18.0 Lb.	9⅝"	43.5 — 53.5 Lb.

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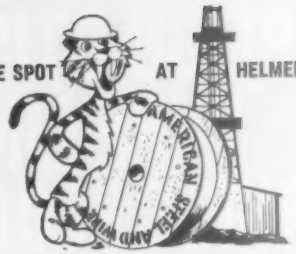
TIGER ON THE SPOT AT HELMERICH & PAYNE, INC.



"We've used USS Tiger Brand Wire Rope

for 40 years—and our men still prefer it!"

Says Lee Daniel, Vice President in charge of operations

Helmerich & Payne, Inc., Tulsa, Oklahoma own some 34 rigs . . . and most of them are equipped with Tiger Brand wire lines. Mr. Daniel says, "We have tried many lines and our boys in the field would rather have USS Tiger Brand than any other line. We're looking for over-all efficiency and we're getting it. Tiger Brand gives consistently good service. The American Tiger Brand Sales Engineer is always on the job when we need special service. We've learned the various cut-off practices that are best—that really work. We keep good ton-mile records and pay attention to them when purchasing wire rope. That's why we've used Tiger Brand for 40 years."

Rig No. 44, shown here, was drilling to 16,000 feet near Chickasha, Grady County, Oklahoma. It was equipped with 7,500 feet of 1¼" Tiger Brand 6x19 Monitor Preformed Rotary Drilling Line with wire core. The crews had drilled to 15,300 feet in 162 days—*and had no trouble with this line.* They expect to get about 120,000 ton-miles from the line.

Mr. Carl H. Young, assistant to vice president, added this comment, "We would like to keep our maintenance figures as low as we can. Ton-mile records prove that we've made the right choice in Tiger Brand."

For complete information about various USS Tiger Brand lines for oil field service, write for our catalog, **American Steel and Wire, Dept. 1266, 614 Superior Ave., N.W., Cleveland 13, Ohio,** or contact our nearest distributor. *USS and Tiger Brand are registered trademarks*

American Steel and Wire Division of United States Steel

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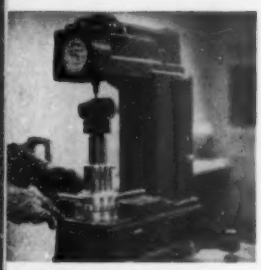
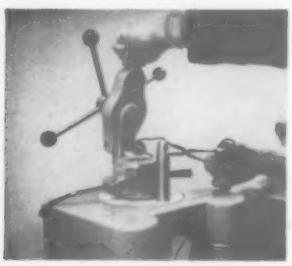
200,000 lb. Full Section Tensile Tester

In-Plant Chemical Analysis

YOU GET BETTER PIPE



Rockwell Hardness Tester



Macro-Etching Studies

Quality Control During Run

Final Inspection

FROM TEX-TUBE

Most pipe mills are rarely expected to provide anything more than average product, good service, fair price. Tex-Tube believes two more steps are necessary: 1) Rigid, uncompromising quality control of the product line and 2) Continuous research toward development of new and improved products.

To that effort, Tex-Tube has inaugurated a Research and Development program calculated to match anything offered in the industry.

This Research and Development program at Tex-Tube has two very tangible benefits for you—

1. You'll get **better pipe**
2. You'll get new products to improve your own operation

The photographs here show just 12 of the quality control steps through which Tex-Tube pipe goes including our metallurgical laboratory, our chemical analyses, our in-line control check points.

When you need pipe, specify Tex-Tube — and know that you get the best-**first.**

LITTLE MILL SERVICE/BIG MILL QUALITY

TEX TUBE

Pipe Manufacturers: High Tensile Lightwall Pipe/Oil Well Casing/Oil Well Tubing/Structural and Mechanical Tubing/Shot Hole Casing/Upsetting, Theading, Normalizing

1503 North Post Oak Road, Houston, Texas • Sales Offices in Midland, Dallas, Denver, Tulsa, and Los Angeles.

the Journal said...

50 years ago

August 24, 1911

A foundation has been formed for the Drake Memorial Museum and Library at Titusville. In charge is Edwin C. Bell of that city, trustee. Ample ground has been donated and August 27, the fifty-second anniversary of the completion of the first well drilled for oil will be observed as Donation Day. "It is strange and lamentable that there is no other industry so rich in material wealth or so remarkable in its history that is so poor in public or semipublic institutions, or associations typical of it, as the oil business."

25 years ago

August 20, 1936

Phenomenal growth as a rapidly developing oil center has brought the city of Corpus Christi to the attention of oil men throughout the country. The progress of Corpus Christi is based on fundamental trends which presage even greater expansion for that city. Fully 100 rigs are drilling in a four-county area surrounding the city.

The deepest test ever drilled in the East Texas district, structurally, was abandoned this week by Pure Oil Co. in southern Rusk County. The 1 Faulkner in the William Elliott Survey, 5 miles east of Mount Enterprise, went to 7,799 ft., drilling 475 ft. into the Travis Peak topped at 7,324 ft.

10 years ago

August 16, 1951

Shell Oil Co. has broken its own producing-depth record for Louisiana at a Weeks Island field well in Iberia Parish. The 1 H. T. Gonsoulin made 466 bbl. of oil per day through 10/64-in. choke from perforations at 15,296-15,336 ft. This is 188 ft. deeper than the previous record holder at Shell 2 Weeks Gall State, in the same field. The world's deepest producer is Standard Oil Co. 5 Mushrush in Wasco field, Kern County, California, producing from 15,250-15,530 ft.

One of the largest drilling programs in the industry is now being carried on in a four-county area of the Spraberry trend in West Texas by Sohio Petroleum Co. The firm has 46 drilling rigs in operation and has completed or is completing 21 oil producers. Sohio's activities are centered in Midland, Glasscock, Upton, and Reagan counties.

The Interior Department is embarked on a campaign to make common carriers out of all pipelines over which it can exert any shadow of jurisdiction. Interior lost its first bout and has been forced by courts to allow El Paso to complete an interstate line in Arizona.

JOURNALLY SPEAKING

CONNOLE in Red Square, with the walls of the Kremlin at left and the mausoleum of Lenin and Stalin in front of them. St. Basil's cathedral, now a museum, is in the background.

Fascinating, nyet?

William R. Connole returned from his recent tour of the gas fields of Russia considerably fascinated but somewhat relieved.

His fascination stemmed from the signs of raw, rugged progress he saw in the Soviet Union. The relief was at being back in the United States.

(Connole, a former Power Commissioner who is now a private attorney in Washington, is currently writing a series for the Journal about the trip of the U. S. delegation. The third installment is in this issue, Page 62).

Connole is an intense person whose active and alert mind soaks up information and impressions like a sponge. And he found plenty of each while in Russia.

He remembers, for instance, the sight of a Russian taxi driver working beneath his vehicle while his passengers waited for him to make the repairs. Seems that in Russia a cab driver is required to be a mechanic, too, so if something goes wrong it is up to him to fix it. A mite inconvenient to the passengers, perhaps, but it avoids the "waste" of having a garage mechanic come out and do it.

Connole, having served a hitch on the FPC, was especially interested in the results of the total control the soviet government exercises over its natural gas.

No problem there about area-pricing or cost-of-service regulation. No problem stemming from competitive firms trying to serve the same consumer market. And certainly no problem about obtaining right-of-way.

But there was a cloud marring this sunshiny picture: governmental bureaucracy.

The net result, as Connole saw it, is a ponderous movement which makes progress chiefly because the Russians have the manpower and the natural resources to throw behind any given program.

When the Russian gas delegation visits this country next month, Connole will be involved in helping serve as a host, at least in Washington.

Perhaps if the Russians are given an exposure to the FPC they will go home shaking their heads over the governmental bureaucracy in this country.

Seriously, in Connole's opinion, there is no point in underrating what the Russians have done or the potential they have to achieve much more. For the most part, the U. S. delegation was impressed—but not awed—by what it saw in the Soviet Union. It is quite likely that the Russian delegation will leave our shores with somewhat the same view.

But back to the lighter side:

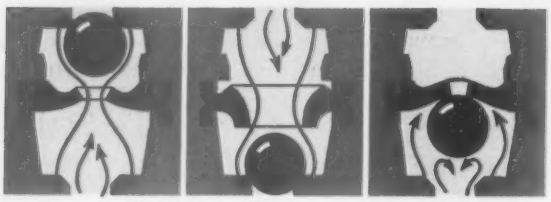
A lasting impression Connole came away with was of the rugged, heavy-duty work many of the Russian women do in the oil and gas industry and elsewhere.

When he came back to the states he mentioned this to his wife, hinting that maybe she'd like to tone up her muscles a bit by getting a job with a pipeline spread or maybe as a gandy dancer on a railroad. He reports that as nearly as he could translate it, her reply was "nyet."

—Clyde La Motte

Product No. 160-D

"Only two working parts — yet, this BAKER Flexiflow equipment gives you controlled fill-up plus a positive-acting check valve"



How Flexiflow's Variable Valve works:

As casing is lowered, pressure below the valve increases and the opening in the diaphragm enlarges so that casing can fill faster. As rate of lowering decreases, pressure decreases, and the opening contracts so that casing fills more slowly. The result is automatically controlled fill, with effective relief from pressure surges. To cement, a Baker float ball is pumped through the diaphragm and into the lower cage. There the ball is trapped, functioning as an effective back-pressure valve.

BAKER FLEXIFLOW FILL-UP SHOES AND COLLARS

What could be simpler? You run casing in a normal manner and rate. And because Flexiflow's Variable Valve fills your casing from the bottom, automatically balancing the *rate of fill* with the *rate of lowering*, you need not worry about destructive pressure surges that can damage weak, porous, or permeable formations. When you are ready to cement, pressure your casing to approximately 700 psi and the back-pressure valve is activated.

Regular and Circulating-Type Flexiflow Fill-up Equipment is available at your supply store in shoes and collars to fit any casing program. To learn more about this better way to run casing, contact your local Baker man. Or, write Baker Oil Tools, Inc., Box 2274, Terminal Annex, Los Angeles 54, Calif.

FLEXIFLOW FILL-UP EQUIPMENT

BAKER OIL TOOLS, INC. HOUSTON | LOS ANGELES | NEW YORK

BAKER

Until FPC has a goal, any pricing effort is futile

IT IS NOT SURPRISING that the Federal Power Commission's chief examiner has recommended that FPC abandon its area approach to regulating gas prices even before the first area hearing.

A year ago when FPC announced the area experiment, a perplexed industry hoped it might point a way out of the regulatory dilemma if the commission would say what evidence it wanted and how it might apply it.

But two series of prehearing area conferences have only confused the issues further. Neither FPC nor any branch of the industry has offered any practical plan of procedure. So formal hearings will open without goal or guide.

AREA PRICING WILL WORK if FPC will say—or if Congress will tell it—what are the elements of a "reasonable" price for gas and then outline in general terms the type of evidentiary data having a bearing on that determination.

If the fog generated by historical enmities, preconceived notions, entrenched positions, and legal tangles could be cleared away it would become evident that there are two principal elements in the reasonableness of a price: Competitive market conditions, and the supply situation.

These factors are not capable of exact measurement by reference to Blackstone's Commentaries or Corpus Juris, nor by the detailed disciplines of cost accountancy—which may be why lawyers and accountants pay them scant attention.

But they make sense, and they can be evaluated by objective men supplied with pertinent data and willing to exercise practical judgment.

On the market side, FPC could weigh the degree of competition among sellers and buyers, prices in nonregulated markets, what interstate buyers are willing to pay, prices of competing fuels and gas from other sources, market-growth prospects, and similar factors.

On the supply side, FPC could evaluate reserve and discovery ratios, drilling rates, cost trends, demand forecasts, volume of uncommitted supplies, revenue requirements of the producing industry, and similar influences on current and future supplies.

THE NEW HARRIS BILL, which has aroused the enthusiasm of nobody because it is a composite of many views, would direct FPC to determine reasonable market prices for gas by considering "all relevant facts of an economic nature."

That ought to be enough authorization. But perhaps Congress will have to spell out for FPC what is relevant and what is of an economic nature, since it seems unable to determine that for itself.

One thing is certain: Until the participants have some idea of the purpose of an area pricing hearing, the examiner is quite right in saying that there is not much point in holding one.

A refinery is born

The first stirrings on the site of a refinery-to-be. The scene here is in **Belfast, but it is typical** of many other sites – in **Europe, Africa (North, South, East and West)** and the **Middle East.**

In sixteen widely separated places refineries are being planned or built or are undergoing major expansion by BP and its associates... tangible symbols of progress with British Petroleum.

BP

First-Half Showing of Smaller Companies

	Gross Income		Net Income		Refinery Runs (bbl. daily)		Liquid Production (bbl. daily)	
	1961	1960	1961	1960	1961	1960	1961	1960
Ambassador	$ 2,914,537	$ 3,278,416	$ 394,867	$ 693,953	.....	.....	5,039	5,727
Amerada	50,722,000	51,829,000	14,141,293	13,723,443	.....	.....	.....	.....
American Petrofina	38,000,000	35,000,000	820,000	(385,000)	.....	.....	.....	.....
Apco Oil Corp.	29,498,000	28,631,000	1,743,283	901,639	30,675	30,134	.....	.....
Argo Oil	8,025,435	7,292,215	2,791,721	2,253,160	.....	.....	14,251	12,612
Aztec Oil	4,679,840	4,166,977	2,648,678	2,443,816	.....	.....	7,230	6,498
Colorado Oil & Gas	23,825,000	22,587,000	2,151,810	(313,414)	16,408	16,638	9,949	6,840
Crown Central	31,323,243	32,103,275	182,720	(159,963)	.....	.....	.....	.....
Delhi-Taylor	57,900,000	47,300,000	2,750,000	2,150,000	.....	.....	.....	.....
Eason Oil	2,119,791	1,801,968	370,117	83,726	.....	.....	1,700	1,514
Honolulu Oil	25,264,764	23,568,472	6,580,900	5,614,737	.....	.....	61,169	46,441
Intex Oil	999,664	1,024,977	184,903	(32,423)	2,128	2,240	.....	.....
Kern County Land	47,520,000	45,807,000	8,312,000	7,272,000	.....	.....	56,200	58,600
Kimbark Co.	388,277	808,588	304,805	725,531	.....	.....	.....	.....
Louisiana Land	24,137,231	22,150,195	11,873,706	11,061,787	.....	.....	127,313	111,057
Murphy Corp.	46,812,000	43,396,000	2,340,000	1,898,000	11,936	11,342	14,289	14,668
Nortex Oil & Gas	.....	.....	200,993	58,281	.....	.....	.....	.....
Ocean Drilling & Expl.	4,285,705	4,046,367	778,384	448,475	.....	.....	.....	.....
Olin Oil & Gas	23,808,241	23,621,008	1,864,781	1,625,089	.....	.....	3,755	3,709
Pubco Petroleum	1,850,956	1,164,780	760,598	271,241	.....	.....	.....	.....
Shamrock Oil & Gas	30,443,021	32,293,725	4,810,651	5,017,528	21,979	22,072	5,292	5,463
Signal Oil & Gas	162,992,000	151,880,000	5,927,000	7,604,000	79,300	78,100	78,000	80,300
Texas Gulf Producing	.....	.....	2,425,000	2,414,000	.....	.....	.....	.....
Texas Natl. Pet.	3,014,531	2,703,896	300,527	179,655	.....	.....	.....	.....
Texas Pacific	13,524,115	13,245,950	3,522,901	3,967,628	.....	.....	.....	.....
TXL Oil Corp.	6,574,000	6,510,000	1,320,000	1,390,000	.....	.....	11,250	11,200
Wilcox Oil	2,946,325	2,830,177	383,452	446,138	.....	.....	.....	.....

First Half Just Fair for Independents

• Mixed reports from smaller companies forbid any flat conclusions about ups and downs in the earnings picture. But it's obvious that the majors did better. Things are expected to improve in the second half.

SMALLER integrated oil companies and the independent producing firms are enjoying a fair year financially so far in 1961, but their performance as a group has not been as spectacular as that of the majors.

First-half reports from the independents are so mixed that general conclusions are hazardous. Earnings of a few companies are up sharply over the same period last year, while most of the others show only nominal gains. Seven out of 27 representative firms report a decline in earnings.

The smaller companies tend to suffer more than the majors from regional gasoline price wars or from production cutbacks in prorated states. They are less likely to offset these income losses with gains in other areas or overseas.

As for the outlook over the rest of the year, most independent executives who have commented are optimistic. They count on special circumstances plus general improvement in the national economy to offset production or pricing troubles.

The producers . . . Two of the larger and better known independent producers—Amerada and Honolulu—recorded increased earnings in the first half.

Despite a poor second quarter, Amerada showed net income for the first half of $14.1 million compared with $13.7 million for the same period last year.

Honolulu, on the other hand, had an excellent second quarter—$3.4 million compared with $2.35 million last year. This boosted earnings for the 6 months to $6.5 million. Honolulu's gross production of both crude oil and natural gas was higher in the first half.

Kern County Land Co. experienced a 14% increase in earnings for the half. President Dwight M. Cochran says factors contributing to the improved earnings were in-

Career Government Man Heads Import Agency

A CAREER government employe with only a smattering of oil-related experience has been appointed administrator of the Oil Import Administration to succeed Lawrence J. O'Connor, Jr.

He is J. Cordell Moore, 49, of Washington, D. C. He has held government positions since 1936, the latest being an 8-year hitch as director of Interior Department's Division of Security.

This division, as the name implies, deals with the security of classified information and with security-related activities of Interior personnel.

Before taking that post in 1952, Moore had served 2 years as assistant director of Interior's Division of Property Management.

His other government service included the National Park Service, the Office of Alien Property in the Justice Department, the State Department's Office of Foreign Liquidation, and the Reconstruction Finance Corporation. He also was for a time in the office of Congressman James M. Barnes of Illinois.

During World War II he was a Navy petroleum supply and logistics officer, and since 1950 has been a member of a Naval petroleum company. He is a commander in the U. S. Naval Reserve.

Born in Illinois in 1912, Moore attended public schools there and was graduated from Illinois College in 1936. He later received a law degree from Georgetown University and did graduate work in petroleum geology at American University in Washington, D. C.

There was speculation in Washington that a government career man was chosen for the oil post to avoid any controverssy that might have developed had a man from any segment of the oil industry been named.

It is also considered likely that OIA will have even less voice in policy-making than it has had in the past.

creased income from oil operations and lower oil-exploration charges. Production actually declined 2,400 bbl. daily from the first half last year.

Other producing companies with increased profits include Argo, Aztec, Eason, Louisiana Land, Olin, Pubco, Texas Gulf Producing, and Texas National Petroleum.

Three of the producing companies with declines in earnings encountered special circumstances which explain the poorer performances.

Ambassador wrote off a $105,000 loss sustained by its Colombian subsidiaries. Coupled with a drop in crude production, the Colombian loss resulted in first-half earnings of $394,867 compared with $693,953 for the period last year.

Texas Pacific earned slightly less in the first half despite a higher gross income than last year. President Eugene T. Adair explains the decline was due to a necessary increase in allowance for capital extinguishments, such as dry-hole expense, surrendered leases, depletion, and depreciation.

Wilcox has had trouble developing income from several expensive gas properties because of lack of a market. The first-half decline in profits reflects this situation, President F. H. Dunn says. He has told stockholders, however, that negotiations are nearly complete on several gas-sales contracts, and the new connections will improve the earnings picture.

The refinery story . . . The integrated independents generally are having a good year.

Ashland Oil & Refining experienced a brisk spring quarter with net income of $3.2 million compared with $2.8 million last year. Its income for 9 months ending June 30 was $10.7 million compared with $9.9 million.

Ashland Board Chairman Rexford S. Blazer sounds a note of warning. He says that despite a gratifying increase in sales, the profit margins in refining and marketing continue to be depressed. He blames overproduction of crude and excessive rates of refining, plus efforts of some larger oil companies to increase their share of the market by extending operations into new areas.

Murphy Corp. showed a 23% increase in earnings, and attributed the gain to increased marketing volumes and better integration of facilities. Crude oil and gas liquids production actually declined, due mainly to lower production rates in Venezuela. Domestic production, especially in natural gas, increased.

Colorado Oil & Gas enjoyed a remarkable about-face in the first half, earning a $2.1 million profit compared with a loss of $313,414 in the first 6 months of 1960. President W. C. Norman attributes the improved conditions to increased oil and gas sales, more stable prices for refined products in the marketing area of the Derby Refining Division, and lower operating costs.

Apco Oil Corp. showed up well in its first report card since becoming strictly an independent refiner and marketer. Apco purchased the refining, transportation, and marketing assets of Anderson-Prichard on March 31.

Net income for Apco in the second quarter was $745,746 compared with $386,812 from the same properties last year. First-half earnings were $29.4 million compared with $28.6 million the year before.

American Petrofina also began to harvest good returns from its expansion program. First-half profits were $820,000 compared with a loss of $385,000 last year. President Harry A. Jackson says he expects the company to reach all-time highs in revenues and income in 1961.

Petrofina has had a remarkable growth in marketing since it was organized 5 years ago. During these years the company has spent more than $11 million in acquiring and developing 2,000 retail outlets in 13 Mid-Continent states. Gasoline sales have increased at the rate of 7.8% annually.

Jackson says 1962 income should be substantially helped by the first returns on new investments in manufacturing and transportation.

Crown Central Petroleum also returned to the black in the first half and expects an even better second half when a new chemical plant at its Houston refinery comes on stream. Crown Central also has been allowed an increase in its quota to import foreign crude.

Shamrock Oil & Gas earnings dipped slightly to $4.8 million in the first half from $5.01 million last year. The company had slight declines in crude production and refinery runs, but still shows higher earnings than in 1960 if non-recurring income is deducted from last year's figures.

Signal Oil & Gas showed a big jump in gross income, but its net declined to $5.9 million from $7.6 million the year before, reflecting unstable pricing conditions on the West Coast earlier in the year.

Two privately owned companies—Vickers Petroleum and Rock Island Refining — both are having better years in 1961 than in 1960.

President J. A. Vickers says his company is showing an 8% gain in refinery runs, and a 15.2% increase in crude production. Net income as a result showed a great improvement for the 6 months.

Vice President L. E. Kincannon says operations of Rock Island Refining were considerably better in the first half of 1961 than they were in the same period of last year. He adds that he isn't optimistic about results for the last half, in view of deterioration of product prices recently.

Drilling better . . . A few publicly owned drilling companies reported increased earnings, reflecting an improved outlook—particularly in offshore drilling.

ODECO had a net income of $778,384 for the first half compared with $448,475 last year. Oil and gas sales, however, accounted for a greater percentage of gross revenue — $609,936 this year and $409,581 last year.

Reading & Bates Offshore Drilling Co. earned $479,688 for the first 9 months of its fiscal year compared to a loss of $158,692 last year. The company's financial position will be stronger the rest of the year since a long-term debt to bank and supply companies has been paid in full.

Helmerich & Payne showed a net income of $1,696,000 for its first 9 months compared with $370,000 last year. President W. H. Helmerich, III, said a major portion of the improvement in earnings can be attributed to operations of the contract drilling division.

Watching WASHINGTON

Clyde La Motte

• House oil-import study will cover everything . . .

IT IS a large-sized chore that Rep. Tom Steed (D.-Okla.) has set for himself and his House Small Business subcommittee.

Steed wants to gather all the pertinent facts and figures on this nation's energy resources, particularly on oil and coal.

He wants to determine the minimum level of domestic oil necessary to maintain the nation in time of emergency, and he wants to find what obstacles are in the path of domestic producers who would supply that oil.

An underlying motivation, too, is this: Steed wants the general public to have a better understanding of the nation's dependence on oil and of the problems of the domestic oil-producing industry.

He thinks the public is inclined to take for granted our supply of oil without realizing the jam we would be in if we were to be caught short. So one aim of the subcommittee will be to jar the public out of its lethargy, thus setting the stage for whatever action may be needed to keep the domestic industry strong.

• Emphasis will be on independent producer's plight . . .

THERE seems little doubt that in Steed's opinion the present mandatory oil-import-control program isn't getting the job done.

Steed is not openly critical of Interior Department's handling of the program, but he obviously wouldn't be directing a subcommittee study if he felt that the oil situation was A-OK.

One big reason Steed considers the present program inadequate is the complaints he hears from small independent producers who say they are having a tough time. Therefore, much of the emphasis of the subcommittee's investigation will be in establishing specifically the state of health of the little fellow.

• Subcommittee will have statistics by the bushel . . .

THE FIRST step in the subcommittee's work is already under way. This is the gathering of information through use of a detailed questionnaire that has already been mailed to hundreds of big and little oil companies (OGJ, August 14, p. 82).

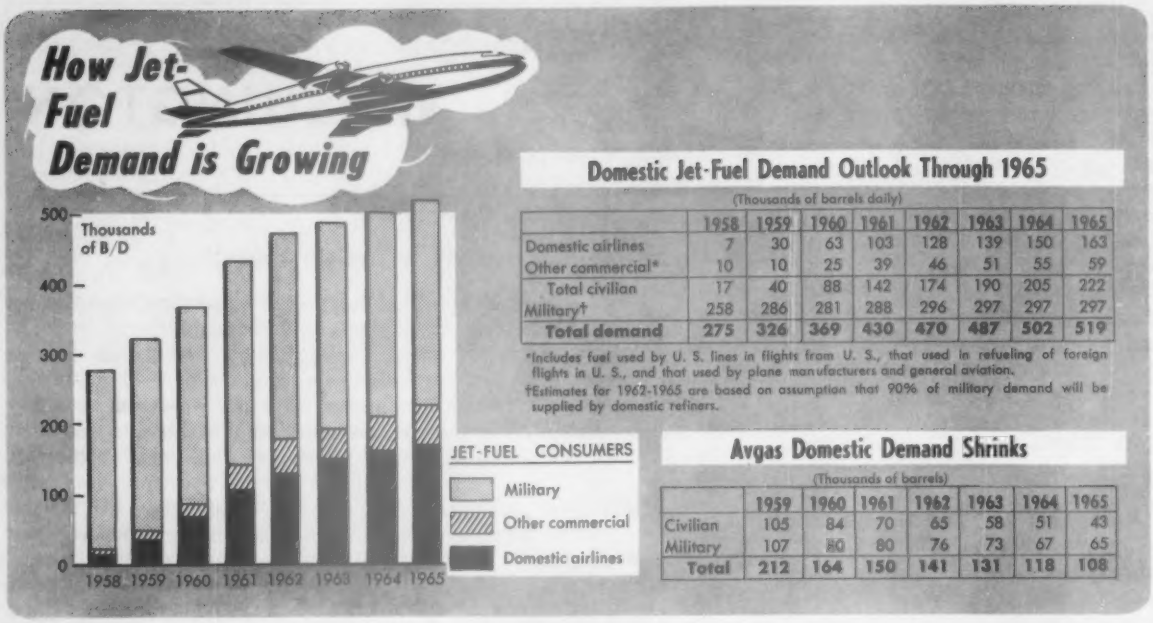
This will be used to supplement other factual information already being obtained from governmental agencies, state regulatory commissions, and others. There will be data, too, to provide the oil picture for the continent and the Western Hemisphere. And, to put all this in proper perspective, there will be world-wide data.

After the subcommittee has gathered and digested the raw facts, it will then map plans for a public hearing. As it stands now, there is little likelihood that such hearings can get under way before late September or October.

At these hearings, top Interior officials will be asked to spell out their view of the picture, what they have done and what they intend to do. Some state officials will no doubt be invited to outline the situation as they see it. Finally, oil and coal industry groups will be asked to state their cases.

The last step will be the drafting of a report by the subcommittee.

It's an ambitious project.



Domestic Jet-Fuel Demand Outlook Through 1965

(Thousands of barrels daily)

	1958	1959	1960	1961	1962	1963	1964	1965
Domestic airlines	7	30	63	103	128	139	150	163
Other commercial*	10	10	25	39	46	51	55	59
Total civilian	17	40	88	142	174	190	205	222
Military†	258	286	281	288	296	297	297	297
Total demand	**275**	**326**	**369**	**430**	**470**	**487**	**502**	**519**

*Includes fuel used by U. S. lines in flights from U. S., that used in refueling of foreign flights in U. S., and that used by plane manufacturers and general aviation.

†Estimates for 1962-1965 are based on assumption that 90% of military demand will be supplied by domestic refiners.

Avgas Domestic Demand Shrinks

(Thousands of barrels)

	1959	1960	1961	1962	1963	1964	1965
Civilian	105	84	70	65	58	51	43
Military	107	80	80	76	73	67	65
Total	**212**	**164**	**150**	**141**	**131**	**118**	**108**

What's Ahead for Jet Fuels

• Demand will climb steadily as airlines add more jets. But it will shoot up when the supersonic military jets—followed by transports—enter the picture. What's bothering refiners: Today's fuels won't be suitable.

D. H. Stormont
Refining Editor

ANOTHER big upsurge in jet-fuel demand is coming in the mid-sixties. But it's already posing some knotty problems for refiners.

Supersonic military planes will be in wide use within a few years. And not long after that will come the era of the supersonic jet transport.

The appetites of the supersonic jets will be enormous. The transports, for example, will burn some 115,000 gal. each in an 8-hour day, compared with 18,000 gal. needed by today's long-range jets.

The military supersonic planes will be here in number by 1965—even earlier if world tensions speed up the preparedness program. The civilian transports will arrive sometime after 1970, and probably before 1975.

In the meantime, there won't be much letup for refiners. The present sharply-climbing demand curve for jet fuels will ease off somewhat next year, but it will keep climbing steadily until the supersonic jets accelerate it upward sharply again.

It's these supersonic jets that have plane makers and refiners pondering the question:

What will be the best fuel for powering such mighty aircraft?

Present fuels won't work. They aren't suited to the high temperatures and other operating conditions that accompany supersonic flight. Better thermal stability, greater density, lower volatility, and other changes are required.

Fuel cost will be all-important to the supersonic transport. Some 60% more fuel will be needed to fly the same ton-miles covered by today's subsonic transport, so fuel cost will account for a higher proportion of direct operating expense.

Current demand . . . Because economics will influence the timetable for adoption of supersonic transports, a look at current airline operations is needed in any discussion on fuels of tomorrow.

Domestic demand this year is feeling the full effect of the airlines' switch from piston planes to jet transports. Demand is also reacting to the partial displacement of prop-jets by pure jets, which burn more fuel.

Based on the half-year record, 1961 consumption will average about 430,000 bbl. daily. This would be a 61,000,-bbl. gain over 1960 and more than 100,000 bbl. over the 1959 average.

Almost all of the increase is due to greater civilian use. Military demand, after a slight drop last year, may rise 7,000 bbl. to a 288,000-bbl.-daily average.

. . . The civilian increase is a reflection of the rapid buildup in the domestic jet fleet. A year ago, U. S. carriers were operating 259 prop-jets and 169 pure jets. The current fleet is made up of about 245 turboprops and 250 jets. From the fuel-consumption viewpoint, it is noteworthy that while there are some 80 more turbojets, the number of turboprops declined slightly.

Another good increase in jet

fuel use apparently is in store for 1962—some 40,000 bbl. daily. That civilian demand will reach the 174,000-bbl.-daily mark, and possibly go even higher, is borne out by the large number of jets on order last May 31 (see table).

At that time 140 jets and 51 propjets had been ordered by U. S. carriers for delivery later this year and during 1962. A total of 80 transports were on order for delivery in 1963 and later, all turbo-jets.

From the fuel-consumption viewpoint, an important development of the past year is the emergence of the turbo fan-powered jet. American Airlines is converting all of its Boeing 707's to fan-type jet engines, increasing their thrust, speed, and range.

. . . Military jet-fuel use will remain near the 300,000-bbl. level during the next 3 years, according to estimated requirements of the Defense Department. The demand figures shown are based on the assumption that 90% of the military need will be supplied domestically. Domestic demand thus could be some 15,000 bbl. more or less than the estimates shown.

Offsetting the rising demand for jet fuels, aviation gasoline is shrinking in importance. Last year civilian demand for jet fuel exceeded that for avgas by about 4,000 bbl. daily.

During the next 4 years an estimated 200 piston planes will be retired annually. Thus by 1965 avgas demand may be down to about 40,000 bbl. daily.

Since the future demand figures are based on Defense Department requirements issued last October, both the avgas and jet fuel data could prove to be too low. A stepup in national defense, as requested in late July by President Kennedy, could result in much higher demands for 1962 and later.

Kerosine tax proposed . . . With some minor exceptions, kerosine-type fuel is used by all U. S. carriers. Although it requires slightly more processing, plus special handling, refinery price of the fuel has been about the same as that for conventional kerosine.

The fact it is less explosive than the JP-4 fuel used in military jets has much to do with the airlines' decision to use the kerosine type. An equally important reason, however, is that it carries no federal tax.

If the proposed 2-cent-per-gallon tax on kerosine-type fuel is adopted by Congress, the airlines will be faced with a tremendous added tax burden. It has been estimated that it would cost the scheduled airlines some $56.5 million in fiscal 1962. Had it been in effect during 1960, it would have changed their $1.2-million profit to a loss of $12 million.

Jets in service and on order

	In service on May 31, 1961*		Ordered for delivery in 1961		1962		1963 and later	
	Prop-jets	Jets	Prop-jets	Jets	Prop-jets	Jets	Prop-jets	Jets
12 Domestic trunklines:								
American Airlines	28	34	...	19	...	21	...	...
Braniff Airways	8	6	...	1	...	1	...	...
Capital Airlines	41	...	...	...	...	...	...	...
Continental Air Lines	13	5	...	...	...	...	...	...
Delta Air Lines	...	15	...	3	...	...	...	...
Eastern Air Lines	39	11	...	16	...	3	...	40
National Airlines	12	3	2	1	...	6	...	...
Northeast Airlines	10	6	...	...	...	...	...	...
Northwest Airlines	9	5	8	6	...	...	...	...
Trans World Airlines	...	43	...	8	...	26	...	...
United Air Lines	...	54	19	14	1	...	...	40
Western Air Lines	12	3	...	3	...	...	...	...
Total for 12 carriers	**172**	**185**	**29**	**71**	**1**	**57**	...	**80**
Other domestic carriers	59	...	21	1	...	2	...	...
U. S. international carriers	...	51	...	4	...	5	...	...
TOTAL U. S.	**231**	**236**	**50**	**76**	**1**	**64**	...	**80**
Free world outside U. S.	483	248	56	67	24	42	...	94
TOTAL FREE WORLD	**714**	**484**	**106**	**143**	**25**	**106**	...	**174**

*Based on annual survey by aviation department of Esso International, Inc.

The supersonic transport . . . How dependent on fuel cost will the supersonic jet transport be? This question was touched on by W. G. Dukek of Esso Research & Engineering Co. at the recent Montreal meeting of the International Air Transport Association.

The military B-70 is scheduled to be introduced in the mid-60's, and Dukek foresees a civilian version coming into use about 1969. But if the fuel for the supersonic transport is to cost much more than current fuel, incentive for the airlines to switch over could be wiped out.

Cruising at speeds of 2,000 mph., these supersonic planes would have a take-off gross weight of 360,000 lb. Of this weight 180,000 lb would be fuel, or about 40,000 lb. more than is loaded in a current long-range jet of comparable size.

In contrast to subsonic jets, which require maximum power only during takeoff, these jets would continually operate at top power in maintaining supersonic speeds.

Although they are expected to cost three times as much, the supersonic transport would be four times as productive as subsonic jets when each type is flown 3,000 hr. per year. But because some 60% more fuel would be required in moving the same ton-miles (fuel cost would account for 50% of the direct operating cost as compared with 30% for the subsonic jet), this apparent advantage would be erased with a fuel costing much more than conventional kerosine-type fuel.

Which fuel will it be? . . . As the situation stands today, the plane designers and engine manufacturers are at somewhat of a standoff with fuel suppliers when it comes to

specifications for the fuels for these supersonic transports. Particularly, the former say they need more information on prospective fuel qualities before they can properly design the air frames and engines.

Because of the low price received for current jet fuel, and the relatively poor volume outlook when compared with the huge gasoline market, the oil industry takes the view that it can't support a large research effort to determine the best supersonic fuel. Thus final fuel specifications are yet to be written.

In supersonic flight the fuel has to be very much more versatile than that used in subsonic flight. Desirable qualities include:

... **High thermal stability,** to cope with temperatures of about 650° F. set up in Mach 3 flight.

... **Low volatility,** so the fuel system will not have to withstand appreciable vapor pressures or require insulation on the tanks.

... **High density,** offering maximum energy content per unit volume.

... **High Luminometer rating** (low luminosity) so there will be less smoking and the fuel will be cooler burning.

... **Freedom from impurities** will be highly important. Presence of sulfur compounds and metals greatly accelerate fuel decomposition at high temperatures.

These desirable qualities, to some degree or other, can be provided in a fuel at a price. But with the airlines claiming they can pay only a little more for a supersonic fuel than they are paying for subsonic fuel, several compromises will probably have to be made.

Opinion of some jet fuel experts is that the best compromise will be a version of the existing kerosine fuel (ASTM type A) with improved thermal stability. Through proper feed-stock selection, a limited amount of additional processing, and use of antioxidant additives, cost of the fuel probably can be held within limits acceptable to the air carriers.

Most hydrocarbons have a satisfactory thermal stability; it's the presence of trace quantities of sulfur, nitrogen, and oxygen-containing compounds which causes the deposit-forming reactions. And since the reaction rate approximately doubles with each 18° F. increase in temperature, even trace quantities will cause trouble at the high temperatures involved in supersonic operations.

As pointed out by Dukek, hydrogenation appears to be a more effective method than SO_2 extraction for saturating aromatics and removing sulfur compounds and metals. But only so much improvement can be accomplished along these lines, and additives and charge-stock selection also will be required.

The fact that trace amounts of contaminants will adversely affect thermal stability indicates extremely careful control will be needed when handling selectively processed supersonic fuel. Careful segregation may be required throughout the supply system in order to assure superclean fuels. In some cases these steps may contribute more to the fuel's high cost than those involving additional processing.

Just what the requirements will be as to volatility, density, and luminosity will depend to a large extent on the design set by the airframe manufacturer. Naphthenic fuels are the best compromise between the requirements for high energy content and the need for high density. Their use, however, requires some sacrifice in combustion characteristics or Luminometer rating.

Paraffinic fuels have the highest heat content per unit weight and have high Luminometer ratings. They likewise exhibit about 20% more cooling capacity than high-density fuels of the naphthenic type. Thus they are more desirable from the standpoint of providing a heat sink for absorbing some of the high temperatures generated in supersonic flight.

Regardless of the route taken—whether the transport's design dictates use of a naphthenic or a paraffinic fuel— the extra stock segregation and processing required will add to the cost.

Near-term outlook is for the civilian jet-fuel market to remain highly competitive. Not only are kerosine stocks excessively high—there is a tendency to obtain minimum profit on kerosine-type fuels. In some instances a low price is quoted the airline, apparently on the premise that a minimum margin is offset by the advertising value gained in supplying fuel to a major airline.

Mobil Finds

- **Drillers save millions by simply applying best operating methods.**
- **Mobil figures saving will show up, too, in years ahead.**

SEVERAL million dollars were pared from drilling costs of Socony Mobil Oil Co., Inc., operating companies last year.

And the new programs which increased efficiency while reducing operating expenses will continue to redound to the benefit of Mobil Oil Co. and Mobil International, Inc.

The sources of the savings were not radically new or revolutionary. They stemmed mainly from the determination that costs could and must be reduced. With this starting point, Mobil adopted two principal courses:

... **A fresh questioning** of traditional practices, especially those which were ultraconservative, to see whether they were really justified.

... **Pooling of the best ideas** of all operating divisions for employment throughout the company wherever applicable.

PROCESSING

British American Oil has acquired a 25% interest in Shawinigan Chemicals, Ltd. Shawinigan Chemicals received $12,078,000 in cash and B-A's half interest in B-A-Shawinigan Co., which operates a phenol-acetone plant in Montreal. Three B-A officers have been appointed to Shawinigan Chemical's board of directors. They are E. D. Loughney, D. L. Campbell, and J. W. Morgan. B-A will continue to supply the phenol-acetone plant with cumene and will supply feed stocks to be used by a new Shawinigan petrochemical plant to be built at Varennes, Quebec.

Fluid catalytic cracking unit with capacity of 84,000 bbl. daily will be built at Sun Oil's Marcus Hook, Pa., refinery. Universal Oil Products

Old-Fashioned Efficiency Cuts Costs

Cost-cutting ideas were exchanged at a world-wide Mobil drilling conference in Dallas early in 1960. Management later examined promising ideas with operating people. After programs were adopted, a follow-up group toured installations to check on their progress. Nothing was left to chance.

Cost-cutting measures . . . Here are some specific savings reported by Mobil and how they were made:

. . . **$150,000-$200,000 per well,** or 30 to 40% of the total cost of the well, in the Kathleen Moore area of West Texas. Use of contract rigs instead of company-owned rigs, better planning, and improved techniques—including increased weight on the bit—were responsible for the economy. As a further effort at saving in this 15,000-16,400-ft. gas field where the discovery well cost more than $2 million to complete, Mobil is requesting the widest spacing ever sought in Texas (OGJ, July 17, p. 44).

. . . **Reduced drill-pipe** and drill-collar failure and hence lower costs by using drilling vibration absorbers in West Texas generally.

. . . **$13,000 per well,** or 50% of the cost of earlier wells drilled in the Lost Hills area in California, for 10 wells. This saving projected on a 49-well program will exceed $600,000. A turnkey drilling contract, the use of water instead of mud where possible, and slim-hole drilling, with smaller casing and tubing, made possible these savings.

. . . **$13,500 per well** in the Los Angeles division, cutting drilling time 26% and bit cost 20% by using an automatic driller which maintains a constant set of conditions. Adjustments are made automatically as required, and do not depend on the alertness of a driller.

. . . **$19,000 per well** in footage costs in Venezuela by using a workover rig for well testing, freeing the heavy drilling rig, plus $156,000 on six wells by slim-hole drilling.

. . . **Up to 50% reduction** of drilling time in Germany by using the turbodrill, which has been especially effective in directional drilling in soft formations.

. . . **$4,300 per well** in Canada by reducing casing from 5½ to 4½-in., streamlining wellhead equipment (reducing the number of valves where excessive caution resulted in use of more than was necessary), using sonic pumps which in tests have pumped up to 50% sand without any trouble.

. . . **$4.23 per foot** in the Hogsback unit in western Wyoming by relaxing deviation requirements from 2-3% to 8%, providing more flexibility in drilling. This was another case of relaxing a too-strict practice.

. . . **25 cents a foot** in the Texas Gulf Coast by reducing waiting-on-cement time. While the industry practice had been to cease operations for 24 hours after cement had been set, Mobil found 8 or 10 hours to be adequate.

. . . **$3,000 per well** by eliminating surface strings in some wells drilled in Oklahoma.

. . . **Reduction in drilling time** to 10,000 ft. in nondeviated offshore Gulf of Mexico wells from 16.8 to 13.5 days. Reducing waiting-on-cement time, increased weight on the bit, and increased rotary speed were the reasons.

. . . **Reduction of warehouse stock** and sale of surplus drilling equipment were sources of savings in all four of Mobil's exploration and producing divisions.

Mobil figures the year's savings won't be a one-shot economy move. The same principles and the same attention to economy should repeat the performance—with another impressive effect on the company's profits picture.

BRIEFS . . .

Co. is licenser of the process. The cat cracker and auxiliary equipment will cost $14 million and will go into operation in October 1962. The huge new unit will replace a fixed-bed unit in operation for 21 years. It will circulate 8,000,000 lb. of catalyst an hour. The regenerator will have a coke-burning capacity of 53,000 lb. of coke per hour.

The No. 3 catalytic cracking unit at Humble Oil & Refining Co.'s Baton Rouge, La., refinery, originally completed in 1943, this month topped the 100,000-bbl.-daily mark for the first time. When the unit was first completed it handled only about 14,500 bbl. daily. As a result of continued expansions, on August 3 the unit handled 101,340 bbl. of total feed.

A $2,500 fellowship for graduate study in asphalt technology has been awarded to Purdue University. Cost of the program is being shared by the National Petroleum Refiners Association and three of its members—American Oil, Berry Refining, and Rock Island Refining.

Sinclair Oil & Gas Co. has bought a small natural-gasoline plant in King pool of Lea County, N. M., from Cabot Corp. Consideration was not disclosed. The plant is about 12 miles south of Sinclair's plant No. 29. Sinclair plans to add equipment to the former Cabot unit and lay a pipeline to No. 29 to bring in more gas from Gladiola and Bronco fields.

Officials of Powerine Oil's refinery at Santa Fe Springs, Calif., expect soon to move throughput of a new Lomax unit up to 3,000 bbl. daily. Nominal charge capacity of the unit, which went on stream recently, is 2,200 bbl. daily (OGJ, Aug. 14, p. 95). The UOP Lomax process converts various distillates to gasoline or a combination of gasoline and middle distillates. The Powerine unit is the first one on stream and is designed to produce about 115 volume per cent of gasoline from refinery distillates.

Gulf Oil Corp. will completely modernize its 37,000-bbl. Cincinnati, Ohio, refinery. This fall, work is to start on a new atmospheric and vacuum crude distillation unit, an alkylation unit, and a hydrodesulfurizer for treating heating oils. In addition, a carbon-monoxide boiler will be added and several existing units completely renovated. With Bechtel Corp. doing the construction, work is scheduled to be completed in 1 year.

It's 8 Days Again in Texas for September

TEXAS producers next week will start their fifth straight month on a record low, 8-day producing pattern.

The Texas Railroad Commission set the September allowable at 2,699,540 bbl. daily—up from August because of the shorter month.

It was disclosed at the hearing that the commission has advised the U. S. Government that Texas could double its production and still be under maximum efficient rates.

West Texas has most of the surplus, the report said. District 8 could produce an additional 1,208,065 bbl. daily. For the state as a whole, the report said, May's production of 2,363,963 bbl. daily could have been increased by 2,427,789 without exceeding MER's.

Refinery Runs Up Sharply During July

Company—	Avg. in bbl. daily*	% of Capacity
Petrofina	26,773	89.2
Atlantic Ref.	214,160	102.0
Bell	6,508	81.4
Bryson Pipe Line	450	41.0
Cities Service	258,621	88.3
Continental	191,644	99.2
Cosden	36,588	85.1
Crown Central	34,998	87.5
Danaho Refining	3,619	30.1
El Paso Natural	22,312	101.4
Gulf	460,372	81.7
Humble	796,000	82.7
Indiana Oil†	670,900	93.1
LaGloria	17,011	70.9
Monarch	2,264	56.0
Ohio	101,752	92.1
Permian	2,286	57.2
Phillips	229,700	83.7
Plymouth	36,391	80.9
Premier	13,781	61.0
Pure	171,872	91.9
Rado Refining	664	44.0
Shamrock	24,949	92.4
Shell	556,822	93.7
Signal	59,540	99.2
Sinclair	303,868	62.1
Skelly	49,880	92.0
Socony Mobil	567,000	79.1
Sohio	149,863	87.9
Standard (Tex.)	50,369	67.2
Sun	205,976	79.2
Suntide	39,365	60.6
Texaco	700,965	94.9
Tidewater	254,032	92.4
Others	2,546	....
July total	6,263,841	....
June total	6,019,624	....

*As reported to The Texas Railroad Commission. †Consolidated Standard Oil (Ind.).

CATC Gas Price: 19.92 Cents (as of now)

- **Four-year-old case still isn't settled. Next comes a review by FPC, then perhaps an appeal to the courts.**

A FEDERAL Power Commission hearing examiner has set an initial price of 19.92 cents per thousand cubic feet in a long-standing CATC group gas case.

The price is on Louisiana offshore gas sold to Tennessee Gas Transmission Co. by the CATC producers — Continental Oil Co., Atlantic Refining Co., Tidewater Oil Co., and Cities Service Gas Co.

Last week's decision by the examiner, Ewing G. Simpson, was the latest in a series of steps that has led through the commission, up to the U. S. Supreme Court, and back to the FPC.

The original hearing examiner's decision—made by Simpson in 1957—authorized the sales at the proposed initial price of 21.4 cents, plus tax.

In May of that year, the commission authorized the sales but cut the price to 18 cents, plus tax. TGT urged FPC to reconsider, saying that it must have the gas and that the producers would not sell for 18 cents. So, in June 1957, the FPC removed the price condition, letting the contract price of 21.4 cents stand.

The New York Public Service Commission appealed and a U. S. Court of Appeals set aside the FPC order. The CATC group then appealed to the Supreme Court.

In June 1959, the Supreme Court sent the case back to the FPC, saying that the initial price must be supported by "substantial evidence" to show that it was in the public interest.

The court held that the 21.4-cent price was higher than any paid by TGT and ruled, further, that TGT's construction of pipelines to the offshore wells "was unsupported by evidence of practice or custom."

The court said a "just and reasonable" rate hearing is not a prerequisite to the issuance of producer certificates, but insisted that FPC must give "careful scrutiny" to initial price proposals.

When the case went back to the FPC, it started through the hearing-examiner stage again and the climax was the examiner's decision last week.

Here is how Simpson arrived at the 19.92 cents:

Comparing the prices at which natural gas was being sold in southern Louisiana in 1954, he set 17 cents as an appropriate 1954 base price for the CATC gas.

Between 1954 and 1956, the examiner found, cost increased by 17.2%, or 2.92 cents per thousand cubic feet. So the base price of 17 cents, plus the cost increase of 2.92 cents, provided the 19.92-cent total.

The examiner said the rate of the return for the producers would be 16.2%, without tax allowances. The

INDUSTRY

Seafarers International Union has won another NLRB round on jurisdiction over crews of ships flying flags of Panama, Liberia, or Honduras. Board ordered a bargaining election within 30 days on the Yarmouth, owned by Eastern Shipping Corp., a Panamanian corporation with most of its business coming from the U. S. Jurisdiction over such foreign-flag vessels remains the hitch in the maritime strike which is heading into the last month of a cooling-off period.

The last of 10 new tankers in a $120-million modernization of Gulf Oil Corp.'s U. S.-flag tanker fleet will be launched August 22 at Beth-

producers had asked for at least 14%, plus tax allowances, while the FPC staff had urged 9%, with credit only for taxes actually paid.

Simpson ordered the producers to refund to TGT the amounts collected in excess of the 19.92-cent rate, plus interest at 6%.

The examiner's ruling is subject to review by the commission. Considering the importance of the case, such a review is likely. In fact, the case will probably go back through the courts once again before it is settled permanently.

Canadians Work Out Method to Move Coal in Crude-Oil Lines

TRANSPORTATION of pulverized coal in oil pipelines may be around the corner in Canada.

A 2-year study of coal pipelining by the Research Council of Alberta has resulted in application for patent rights to the transportation method involved. A field trial is planned for next summer in the Edmonton area.

Object of the RCA research is to find a low-cost way to get Alberta coal to markets in eastern Canada.

An RCA spokesman says it appears pulverized coal can be moved economically to Ontario by using the spare capacity of existing oil pipelines. He expects a cooperative attitude in the oil industry.

Lube Blending Now Automatic

GREATER efficiency and flexibility in blending lubricating oils is made possible by fully automatic electronic controls at Texaco's new plant in River Rouge, Mich.

Representing the nation's first application of electronically controlled lube-oil blending, the multimillion-dollar plant will be used to blend and compound more than 40 types of consumer and industrial oils. As many as six additives and base stocks are mixed automatically by an operator at the console.

The blending equipment and mixing kettles are located on the second story of a 2½-story building. After blending and compounding, the finished lubes are pumped directly to a barrel-filling line on the ground floor.

Base stocks are delivered in bulk by oceangoing tankers from Texaco's Port Arthur, Tex., refinery. Some 300,000 bbl. of storage are provided at the new plant.

BRIEFS . . .

lehem Steel Co.'s Sparrows Point shipyard at Baltimore. It is the 29,250-ton S. S. Gulfsupreme, with a cargo capacity of 250,000 bbl. of oil.

The British American Oil Co., Ltd., deal to buy all outstanding shares of Canadian Devonian Petroleums, Ltd., at $5.10 per share is off. B-A says it didn't get the required 55% by the August 11 deadline. The offer was accepted by holders of less than 35%.

Cities Service has contracted to buy an average of 30 tons a day of liquid carbon dioxide over the next 2½ years. The CO_2 will be used in an oil-field flood project near Pawhuska, Okla., and will be trucked from the Carbonic Chemicals Corp. Solano plant in Harding County, New Mexico.

Union Oil Co. of Canada Ltd. will become the active operator in Canada for Union Oil of California. The company has been on the books for years, but operations have been handled as a division of Union of California. The parent is transferring its assets to Union of Canada for 2,995,000 shares of stock. Stock also will be offered the Canadian public.

Reorganization of Coastal Caribbean Oils, Inc., has been approved by company stockholders. Assets of the firm will be transferred to Coastal Caribbean Oils & Minerals, Ltd., which will be organized in Bermuda.

A water flood which is expected to boost ultimate recovery to 50% of the 15 million barrels of oil in place will be started soon in the Skinner sands of Southwest Mount Vernon field, Lincoln County, Oklahoma. About 2.6 million barrels of oil has been produced from the 6-year-old field. Sunset International Petroleum will be unit operator for itself, Texaco, Wilcox, McMahon Oil Co., Sunray Mid-Continent, and others. Seventy wells in the 1,700-acre field will be involved.

ABC financing has been used in Brazos Oil & Gas' purchase of four leases in Clip field, Texas, from Blair-Vfeeland of Corpus Christi.

RUSH HOUR in Oktyarbrysky, a Russian oil town of 75,000. Question: Where are the cars?

Where Russian gas is headed—Part 3

Soviet Gas Pattern Is Much Like Ours

This is the third of four articles written exclusively for the Journal by William R. Connole, former member of the Federal Power Commission. They are based on observations of the eight-member U. S. delegation of gas men which spent the month of July visiting soviet natural-gas installations. Previous articles appeared in the August 7 and August 14 issues.

FIFTY-ONE per cent of the primary energy used in the Soviet Union in 1965 (in terms of calorific value) will be derived from petroleum and natural gas, only 43% from coal.

In 1955, 65% of the primary energy was derived from coal and only 25% from petroleum and natural gas.

This energy revolution within a short 10-year span is the single most significant non-military factor in estimating the chances of success for Khrushchev's boast "to outstrip the United States economically . . . to surpass the level of production in the United States . . ."

Indeed, it will measure the success of the Soviet Union in achieving worldwide political and economic domination. Only a war of worldwide involvement would have greater effect.

Material civilization advances in direct proportion to its effective use of energy. The dramatic shift in emphasis from relatively immobile solid hydrocarbons to easily transported fluids and gases marks the end of the shortsighted Stalinist era in the industrialization of the Soviet Union. It is the beginning of a much more practical period under post-Stalin leaders. It puts the economic base of Soviet Russia on a footing with that of the United States. In short, it marks the coming of age of the Soviet Union's industry.

Growth of gas . . . Even more remarkable than the combined growth in the use of gas and petroleum, however, is the expansion of the use of natural gas.

Natural gas provided only 2.4% of total primary energy in 1955. In 1965 it will be responsible for 17.5%. And this is during a 10-year period when total energy consumed will have increased many times over.

According to A. P. Agishev, director of the Ukraine branch of the All-Union Scientific Research Institute for Natural Gas, proven recoverable reserves of natural gas early this year totaled 71 trillion cubic feet. This compares with U. S. proven reserves of 273 trillion. But already-prospected areas will add tremendous volumes of reserves to those already proven, Agishev says.

There is little reason to question the figures. The geology of the Soviet Union, according to informed sources, continues the geology of the vast Middle East basin and is conducive to location of petroleum and natural gas across most of the southern tier of the 15 republics

Special report to users of Caterpillar equipment

CAT CATERPILLAR

Parts you can trust
...cost less per hour

New Cat parts stretch dollars "down where the digging's going on"

That's more than just talk! More and more users are conducting their own field trials of ground engaging tools—tips, bits, teeth and edges—to determine which brand gives them the best performance-cost balance. And time after time, they find that genuine Caterpillar ground engaging tools outclass all comers—in production and over-all economy!

Take Cat cutting edges. These edges have been contractor-tested with most of the market's leading brands all over the country. Results: Cat edge wear life—10-60% longer. Cat edge cost—15-50% less per hour. Think of that in terms of dollars!

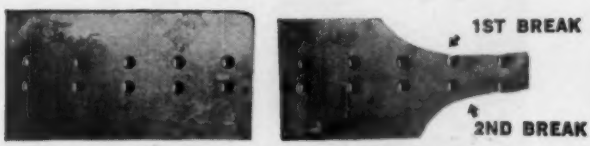
HERE'S A LOOK AT RECENT FIELD TRIALS ON SCRAPER CUTTING EDGES:

Two DW21-470 Scrapers, one with Cat *standard* edges and one with popular brand *thick* edges, were put to work "side-by-side" by a contractor in hard, red clay on an Interstate Highway job. His findings:

Brand	Price	Hours of Life	Cost per Hour
Other	$121.22	1060	$.114
Cat	$128.28*	1360	$.094

HIS SAVINGS WITH CAT EDGES—17.5% PER OPERATING HOUR

*Test completed before recent new low price of $102.30 effective.



CATERPILLAR OTHER BRAND

A Cat 7/8" stinger and another brand *one inch thick* were split in half and a section from each installed on *same* DW21-470 Scraper working in decomposed lava with embedded basaltic boulders. Other brand section broke after 48 operating hours, was reversed but broke again two hours later—a total of 50 hours of life. *Cat edge wear during period was 1/4", other brand 1/2".*

Your Caterpillar Dealer has the facts on many of these tests—go over them with him and start to save more now.

Caterpillar continually up-dates its line of ground engaging tools. Some of the newcomers to the line that "stretch your dollars" are: new self-sharpening end bits and ripper tips, patented reversible router bits, and new-design scarifier teeth for Motor Graders. These new money-savers keep production high, costs down.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

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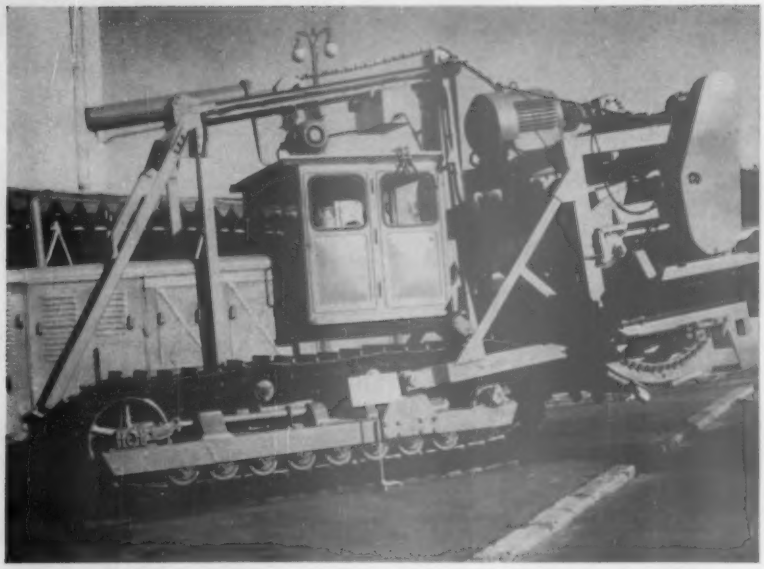


TRENCHING MACHINE in Russia. The electric motor powers an endless belt to move earth to the spoil bank.

RUSSIAN RIG operating with down-hole electric drilling equipment uses these pneumatically operated tongs to make up drill string.

and of the Russian republic itself.

Our delegation finished its tour of Russia with a feeling that Russia's goals for its gas industry probably would be met. They will not be achieved as smoothly, or even as economically as they would be in the United States. But—and this is the dominating impression we received in the USSR—the whole thing will work and work entirely well enough for soviet purposes.

Copy and improve . . . General practice throughout the soviet oil and gas industry is to follow U. S. leadership and copy U. S. methods modified and improved where necessary to meet local conditions.

Thus, the energy balance towards which the Soviet Union is moving will be quite similar to that in the United States.

The heavy emphasis on petroleum and, especially, on natural gas is entirely unlike Europe's traditional dependence on coal. In many respects the methods employed are also purely American. But there are techniques developed by the soviet oil industry that are unique to that nation.

Drilling techniques . . . Much has been written about current soviet drilling techniques. The soviet turbodrill is well-known in the U. S., of course. The delegation observed one such rig in operation in a gas field, but it was making up pipe at the time and nothing much could be concluded concerning rates of penetration, mud control, etc.

We saw a heavy-duty diesel electric rig drilling in the area of the Second Baku near Axapovo in Bashkiria, using the newest down-hole electric drilling equipment. It was down to 11,000 ft. when we visited the rig and, we are told, was making hole at a good clip.

The equipment here appeared to the delegation to be of excellent design and construction. Pneumatic make-up tongs were used here and in several other locations we visited. These were fast operating, powerful, and made for efficient operations. The drilling crew, like all soviet technicians we observed, was obviously well trained and worked smoothly.

The drill stem carries power downhole by cable running through the center and making contact at the joints by a positive closure. The driller claimed the contact was 100% foolproof. The electric motor is completely sealed at the end of the string, and is about 40 ft. long.

Mud circulates around this cable and the motor and enters the hole through the bit in the usual fashion. The driller claimed to be using high-pressure water unless he encountered unexpected formations or pressure conditions, in which case he used barite mud.

At the same rig the conventional rotary cable was being used for drilling when circulation was lost, according to the crew. However, we observed relatively few lengths of drill pipe equipped with the cable and connection, certainly not enough to reach bottom at the depths being drilled.

Mud by pipeline . . . Another drill site provided an operating example of a string of aluminum drill pipe and a central mud-batching plant.

Here mud was being mixed at a central point and piped through lines as far as 60 km. with an inter-

mediate pumping station, to drilling rigs throughout a huge field under intensive development. At the site the mud is stored in tanks.

Although a uniform type, make-up, weight, and consistency of drilling mud was delivered to all rigs, we were told they were not all drilling under uniform conditions. No difficulty was reported, however, by the men in charge.

Pipeline compressors . . . Compressor station construction and generation are another example of U. S.-like practices.

Both gas and electric powered prime movers are used. We saw angle compressors and centrifugals. While the size of the existing units appears to be below that of the U. S., the newer ones and those under construction compare very favorably.

The older line from Rostov to Moscow, a 720-mm. line, was built with gas reciprocal angle compressors. Of course, the first machinery was Clark equipment acquired from the U. S. under the lend-lease program.

As new fields were developed and larger-diameter lines built (800-mm. and up) Glavgas, the state Ministry of Gas Industry, selected gas and electric turbine drive.

Working engines range upwards from 1,000 hp. A 2,000 hp. unit has been built and was on plant test at the time the delegation was in the Soviet Union. The Ministry of Machine Building, the state unit charged with such responsibility, is currently working on a unit of capacity 3,500 to 4,000 hp.

Housekeeping poor . . . The quality of the machinery we saw was excellent. Housekeeping and even maintenance, however, were almost crude by U. S. standards.

Buildings that housed the equipment seemed to have been built virtually overnight. Prefabricated concrete panels and prestressed beams are used almost universally.

The structures are much heavier in type and style than we are used to in the U. S. Almost no steel construction was seen. Even the pipe yards were supported on concrete cradles. Concrete fire walls separating electric-driven engines from the compressors are still used, even on brand new construction.

The machinery foundations are excellent. They are at-site cast concrete. Very little vibration could be felt on operating machinery.

Finish pointing of masonry is virtually unknown around industrial installations. This accounts for the rough and crude appearance of all industrial buildings. Of course, the tremendous pressure to meet construction goals explains the slapdash way of throwing the buildings up. It does not seem to affect the mechanical work, however, which is done to a high degree of perfection.

The haste might also explain, but not excuse, the poor maintenance. For example, we visited one location where the buildings were only a year or so old. I reached for a steel ladder to climb to the top of a run of pipe outside the compressor station. It was supposedly affixed to the concrete cradle by bolts. When I put my weight on it, however, the ladder, bolts, and all came off in my hands, along with part of the concrete! This is not an isolated example, either.

Some pipeline costs . . . Although units are fairly small, the stations are substantial and the lines operate at good pressures. A 30-in. line, for example, operates at maximum discharge pressure of 55 atmospheres. It is clear that the lack of compression is not the reason for the construction of large-diameter lines in the USSR.

Some cost figures are interesting:

A 30-in. line averages 80,000 new rubles ($72,000) per kilometer, including compression cost and housing at stations. Sixty per cent of this cost is materials.

At compressor stations alone, not including design costs or communication facilities, 53 to 60% is installation cost. Of the balance, half is machinery building costs and half assembly at site.

A typical station we saw had 4 units of 20,000 kw. each and cost 2.5 million new rubles ($2.25 million). Costs per kilometer installed were given as 150 new rubles ($135) for gas turbines and 320 new rubles ($288) for gas reciprocating engines. These amounts include an allocation of development costs. It is expected they will be reduced with added production of units.

Trend toward electricity . . . There is a definite trend towards electric power. The twin 4,500 km. 40-in. lines from Gazli field near Bukhara to the Urals area will be as automatic or remote controlled as possible.

Communications systems were advanced, using microwave multichannel equipment built exclusively for the pipeline system.

The producing and pipeline segments of the soviet gas industry are well designed, built and operated. As much cannot be said for the distribution end.

Of course, this is not by accident. It is consistent with the purpose for which the Soviet gas system is being organized, to promote the rapid industrialization of the USSR.

First Helium-Program Contract Signed

THE FIRST contract in the Government's new helium-conservation program was signed last week.

Helex Co., a subsidiary of Northern Natural Gas Co. of Omaha, will build the plant at Bushton, Kans., and sell helium to the Government.

At least three other contracts are in final stages now as part of the program by Interior Department to get 12 such plants constructed by private industry.

Under the contract approved last week, Helex will be paid $11.24 a thousand cubic feet for the helium, up to a maximum of $9.5 million in payments in any one year. The contract, which runs for 22 years, calls for delivery of the first helium by January 1, 1963.

F. C. Nicholson, vice president of Northern Natural, says the plant will be built by the Fluor Corp. and extraction equipment will be manufactured by Air Products, Inc.

Nicholson says the plant will be able to produce raw helium at the rate of 700 million cubic feet a year. The average helium content of the natural gas to be treated is 0.46 of 1%.

Helium to be extracted by Helex will come from natural gas transported by Northern Natural from fields in Texas, Kansas, and Oklahoma.

Streamlined ACT Plan Pays Off for Conoco

• Sizable savings already have been made in Kansas' Geneseo pool, where crude from 10 different leases and a water-flood project is handled through single ACT unit. Company expects to save million or more in next 15 years.

CONTINENTAL Oil Co. is taking automatic-custody-transfer practices one step further.

In Geneseo pool of Rice County, Kansas, it is handling crude from about 90 wells on 10 different leases and a water-flood project through three major metering and test centers and one central ACT unit.

As a result, the company expects to save more than a million dollars over the 15-year remaining life of the field.

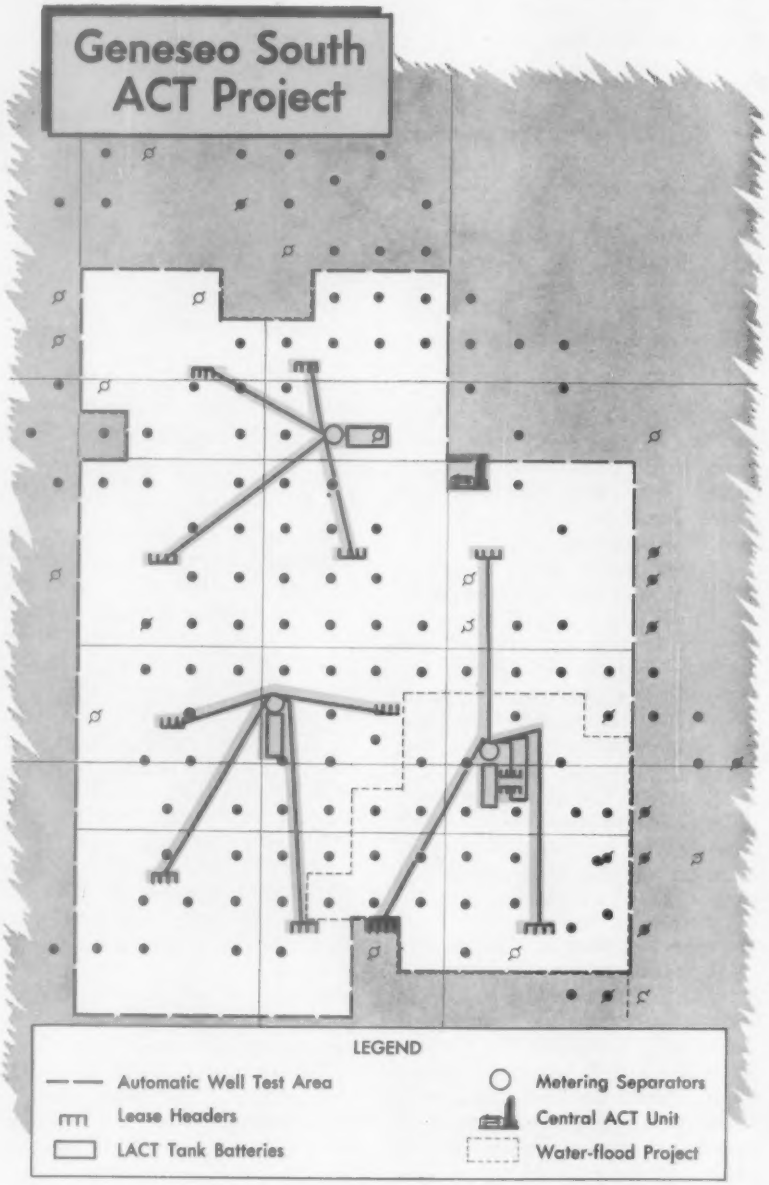
Continental has spent $200,000 to automate the handling of crude from the Geneseo South section of the pool, covering 1,760 acres.

This project has been in operation since December 1959. Total net savings, plus increased net revenues, to December 1960 were $74,-336.

The company expects future savings and increased revenues to average $60,000 a year. The project should be paid out by mid-1962. Nonoperating partners are Cities Service and Shell Oil Co.

Continental's success with this pilot project has brought about the installation of other such projects in other areas.

Similar projects have been put in operation by other companies recently, are being installed, or are on the drawing boards. Anderson-Prichard Oil Corp., Pan American Petroleum Corp., Skelly Oil Co., and others are "centralizing" lease production for automatic testing and dispatching to pipeline buyers.



How it works . . . Each lease is equipped with test headers, a test line to its central battery location, and individual well lead lines.

Production from the leases is routed to three central battery locations for metering and sampling. After the oil production from each lease is metered and sampled, it is piped to a central 500-bbl. surge vessel for the main ACT unit.

When oil reaches a predetermined level in the flow tank, a switch opens a hydramotor valve and oil moves through a PD meter on the central ACT unit to the pipeline. Crude oil is monitored for b.s. and w. content and provision is made for treating nonmarketable oil.

Savings tell tale . . . Four major areas of money savings have been recorded by Continental at Geneseo:

. . . Extra revenue through vapor-loss control. This adds barrels of crude to daily production, and increases the gravity of the entire flow.

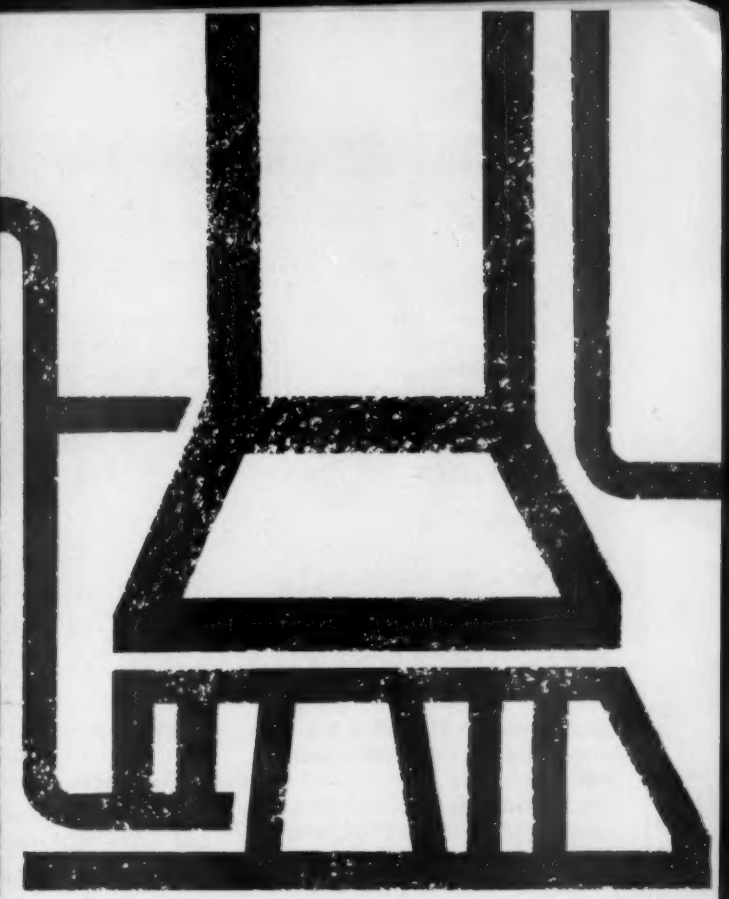
. . . Use of centralized individual-lease metering points and one central automatic-custody-transfer unit has reduced the number of pumper

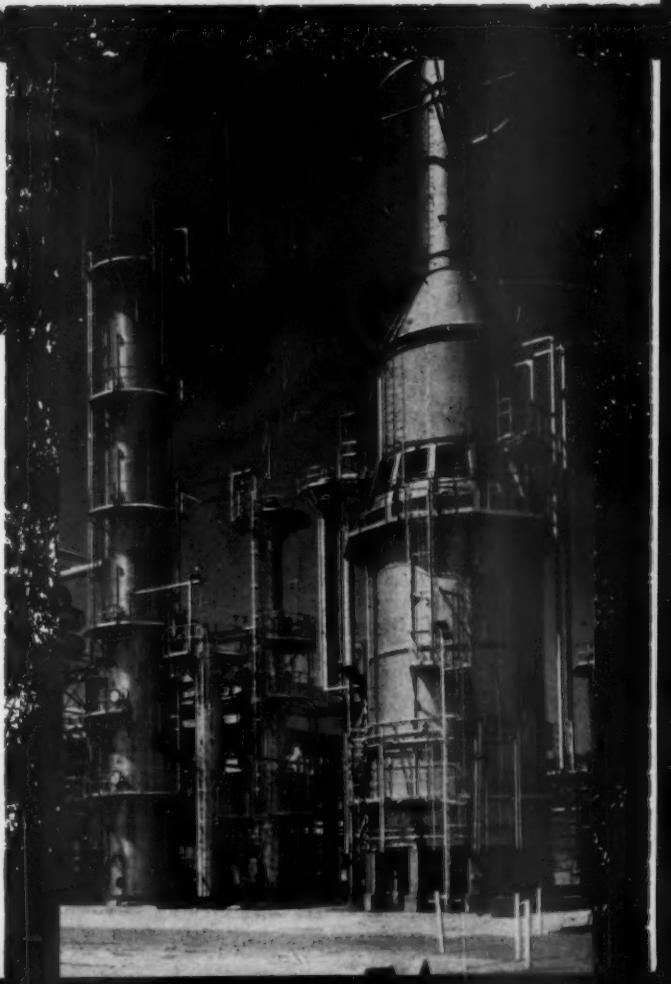
Procon completes African refinery 4 months ahead of schedule

Sixteen months to build a refinery in Mozambique . . . on the east coast of Africa near the port of Lourenco Marques . . . at considerable distances from the industries where almost all the refinery equipment had been constructed.

But build it Procon did! Not in 16 months—but in 12 months. Four months ahead of schedule! A modern 12,000 BSD refinery, it includes Platforming®, Unifining®, Merox™, and crude distillation units plus complete supporting facilities.

On stream for Sociedade Nacional de Refinacao de Petroleos (SONAREP) a subsidiary of the Portuguese petroleum marketing firm, Sociedade Nacional de Petroleos (SONAP), this refinery is another tribute to Procon's proven capabilities... to tackle the toughest job ...and complete it in the shortest possible time.





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THIS small ACT unit on Pan American commingling project uses positive-displacement meter. At left is pipeline pump.

check points. This also has permitted use of centralized testing facilities.

... **Elimination** of replacement costs of most of the 47 wooden flow, settling, and stock tanks, many in service 20 years.

... **An over-all** reduction in operating expenses for testing, pumping, and gaging services which in turn has lengthened the economic life of the properties.

In the first year's operations, the biggest plus item in savings was $35,161 attributed to extra revenue through vapor-loss control.

Tank replacement costs were whittled $28,200 by tying the leases together for measuring, testing, sampling, and dispatching.

General operating expenses were reduced $10,900.

Three to four full-time pumpers formerly handled the leases. Now, one full-time and one half-time pumper care for the load. The other pumpers have been reassigned.

Clerical workload in district offices has been reduced. Number of run tickets processed from Geneseo dropped from 1,540 to 144 a year. Since full automation went into effect, operating expenses have averaged $913 a month less than during other years.

Extra benefits . . . Automatic well testing increases the number of tests for use in production analyses and this has worked for greater efficiency in lease operation, Continental believes.

These savings are difficult to spot but Continental says they are factual in these areas:

... **More efficiency** in placement and sizing of pumping units.

... **Better control** of a waterflood project.

... **Better analysis** and choice of remedial jobs performed.

Among other operational advantages, Continental says less production has been lost due to shut-in time, severe weather, or long week ends.

More frequent test information has resulted in more oil production through planned surface and subsurface equipment changes.

The oil-production-decline rate in the automated area has decreased from 18% per year in 1959 to 5% in 1960, which Continental views as a lump tangible benefit from these hard-to-pinpoint extras.

As a result of the commingling of production for ACT to the pipeline, Continental has developed the extended-period batch treatment for corrosion inhibition. All treating in the Geneseo pool is done by one man. Already, Continental plans to expand the batch-treating type of operation to North Edwards and the Edwards pools nearby.

Wide application . . . The commingling process of producing oil from groups of leases is ideal in areas where conditions make unitization impractical. However, each project must be economically justified.

Continental feels the automatic lease-crude handling system can be installed with only one consideration — agreement of nonoperating partners. Permission of state conservation commissions in Oklahoma and Kansas is not necessary.

E. B. Nicholson, superintendent of Continental's Lyons district in Kansas, believes that notable savings, more efficient operation, and additional revenues—as shown by test operations—are sufficient justification for other projects.

PIPELINE

Construction applications before FPC were reduced $73,769,153 in the second quarter of 1961 and numbered 72 with a total value of $764,349,847 as of June 30, the commission reports. Of the total, 34 had been granted temporary authorizations.

Seven loops involving 35 miles of 30-in. and 21 miles of 26-in. will be laid for Texas Gas Transmission Co. by Houston Contracting Co. The loops are in Tennessee, Mississippi, Arkansas, and Louisiana. Pipe laying is expected to begin in early September.

Two 30-in. loops, one of 38 miles and the other of 40 miles, will be installed in Arkansas for Natural Gas Pipe Line Co. of America.

Gulf Expands Test of New Economy Gasoline

• It looks like the San Antonio and Charlotte story all over again in new markets where Gulftane is priced to compete with private brands.

"I DON'T know what my prices are—the ticker's running behind."

So responded one marketer last week when Gulf Oil Corp.'s answer to private brands—the lower octane, lower priced regular called Gulftane—sent two markets into a tailspin.

Indianapolis, Buffalo, Newport News, Va., and Norfolk, Va., were added to Gulf's laboratory for testing its new price-competition weapon.

Gulftane was first introduced in San Antonio, Tex., where private brands have captured an increasing share of the market (OGJ, July 17, p. 42).

Gulf, a three-grade marketer, withdrew its super-premium Gulf Crest when it installed Gulftane, priced 2 cents below its regular and estimated to be about 2 octane numbers lower.

The new test cities, in common with San Antonio and Charlotte, N. C., have histories of chronic price wars. Sun Oil Co. is marketing two sub-regulars in Charlotte. Here are the latest developments:

...In Indianapolis. Gulftane started out selling at 28.9 cents retail, 2 cents under major brand regular, and the gyrations began. A week later everybody was at 22.9 on regular. Gulftane was at 22.9, Gulf regular was 23.9, and Gulf premium was 28.9, same as other majors. Independents generally were 22.9 for regular and 25.9 for premium.

...In Buffalo. The Indianapolis story was repeated. Suppliers installed temporary allowances or posted reductions of up to 6.7 cents, leaving a net price to dealers of 8.6 cents and a retail of 22.9, including tax, for regular. The premium picture was mixed.

...In Newport News and Norfolk. The immediate reaction was not so violent. Gulftane and private branders were generally 28.9 or 29.9, with majors ranging from 30.9 to 32.9, the normal level before Gulf's price innovation was introduced.

It was the Charlotte and San Antonio stories all over again. The majors wouldn't tolerate a 2-cent differential with another major brand, and the independents wouldn't tolerate even-price competition from a major.

The response of Gulf competitors was uniform. They met with their regular grade the price competition of Gulf's lower octane product.

In the early days of the new price wars marketers were officially "studying the situation." They were ready to disclose no plans other than meeting prices for coping with the Gulf strategy, although marketers plainly saw no solution in price competition alone.

There was speculation that Sun would install its nine-grade system in the Gulftane cities. This system, introduced in Charlotte May 1, has two sub-regular grades priced 1 and 2 cents below major regular.

This would permit Sun to compete with Gulf's lower quality and lower cost product with one of similar quality and cost. As it stands, Sun and other majors are giving away quality and product cost in meeting price competition headon. This situation is creating pressure to develop other means for engaging in price competition.

BRIEFS . . .

Williams Brothers has the contract. One loop will run from Gum Spring to Nydis and the other from Rowhatan to the Missouri border. Three river crossings are involved.

More than 80 miles of pipeline will be built in the U. S. and Canada to serve the Massena-Ogdensburg, N. Y., area. FPC has approved the application of St. Lawrence Gas Co., a subsidiary of Consumers Gas Co. of Canada, to supply the area. Niagara Gas Transmission will take the gas from Trans-Canada and transport it to the border. The line will cross the Cornwall International bridge. St. Lawrence will build 75 miles of transmission and distribution lines in New York.

Two companies, Panhandle Eastern and Trunkline Gas, have been given temporary authorization by FPC to expand capacity 125 M.M. c.f.d. Trunkline will build 97.5 miles of 30-in. main line loops paralleling its existing system at a cost of $14,568,000 to deliver 100 M.M.c.f.d. to Panhandle Eastern and 25 M.M.c.f.d. to Consumers Power of Jackson, Mich.

Completion of the 1961 portion of its 2-year expansion program by November 1 is contemplated by Texas Eastern Transmission. It calls for construction of 330 miles of pipeline and 51,000 hp. in compressor capacity. It will expand Texas Eastern's capacity by 225,000 M.c.f.d.

Temporary authority to construct 187 miles of 36-in. loop lines in Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, and Maryland has been given Transcontinental Gas Pipe Line Corp. by FPC. Included is a 4,000-hp.-compressor station in Louisiana. The additions would add 97,303,000 cu. ft. to Transco's capacity.

Construction of the 60-mile, 8-in. line from Wyoming's Big Piney field to Granger is under way and should be completed by November 1. The line is being built for Service Pipe Line Co. by O. R. Burden Construction Co.

More than 300 miles of distribution laterals will be added in Florida as the result of an FPC ruling. The ruling authorized Houston Texas & Oil Corp. to build 235 miles and Coastal Transmission Corp., 71 miles of laterals. In addition Houston Texas will add 30,000 hp. in compressor capacity.

Texans Argue Both Sides of Small-Tract Issue

• Hot exchanges mark Austin hearing on what kind of allocation formula should be set for Normanna field.

THE Texas Railroad Commission last week tackled its precedent-setting job of establishing a new allocation formula for famed Normanna gas field in Bee County, South Texas.

Following a heated, all-day hearing August 14 in Austin, Normanna operators were ordered to file written briefs within 30 days of receipt of the hearing transcript. Then the commission will make its decision.

The formula it sets may go a long way in determining whether drilling on pint-sized tracts will wane in Texas.

The commission is under a mandate from the state Supreme Court to adopt an allocation rule more equitable to large-acreage holders in the field.

In its ruling on Normanna, the court struck down the commission's traditional formula for gas fields which contain small-tract wells (OGJ, Mar. 13, p. 100). This formula was based one-third on the well and two-thirds on acreage.

The case involved a well drilled by Bright & Schiff, Dallas independent, on a 0.3-acre town-lot tract in Normanna field.

Regular spacing pattern in the field is 320 acres.

The court said there was no doubt that there would be "enormous drainage" from other leases to the Bright & Schiff lease.

The Railroad Commission was directed to adopt a new formula which would be "fair and just to all parties without depriving any of them of his property."

100% acreage sought . . . Major operators in Normanna, who won out in the court battle, unanimously recommended at the August 14 hearing that the commission now prorate field production on a 100%-acreage basis.

Most, however, indicated they would accept a provision that would grant the Bright & Schiff well a special allowable of 200 M.c.f. daily. This would not come under the allocation-formula machinery.

These operators testified they normally did not favor such allowables but recognized "special problems" in the case of the Bright & Schiff well, the 1 Joyce.

Atlantic Refining Co., which has a large working interest in the field and holds acreage adjoining the 0.3-acre Bright & Schiff tract, did not comment on this proposal.

Attorneys for Bright & Schiff fought hard for an allowable for the 1 Joyce of 1,000,000 cu. ft. daily—at least until all well costs plus 7% were recovered.

The Supreme Court's Normanna decision, they argued, did not undo previous court findings that an operator of such a well cannot be restricted on allowables to a point where he is unable to pay out his well and make a reasonable profit.

Furthermore, they charged, the field as it exists now isn't what was pictured by attorneys for Atlantic and Tidewater Oil Co. in the data ruled upon by the court.

H. R. Bright, partner in the Dallas independent firm, told the commission the 1 Joyce would have to be plugged if a 100%-acreage formula is adopted. He said he would "very rapidly" agree to such a formula, however, if the well were permitted to recover its cost plus 7% before the formula was imposed.

Even more drainage? . . . J. W. Stayton, Austin attorney for Atlantic, struck hard at the proposal for a 1,000,000-cu.-ft. allowable.

This, he said, would result in an even higher allowable for the small-tract well than it would get under the invalidated formula.

Stayton said Bright & Schiff is asking for authority to produce as much gas from its well as a full-size tract would be allowed to produce. He said this would amount to allocating 100% on the well rather than the 33⅓% under the old formula.

Stayton drew an admission from Bright that this was true for the 8.3-year period the latter contended was needed to achieve a payout and 7% profit.

J. W. Stayton, Atlantic: Standing firm for 100% acreage.

Robert Payne, for Bright & Schiff: Reasonable profit.

Jack Jones, Tidewater: Willing to compromise.

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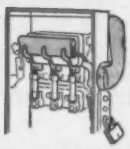

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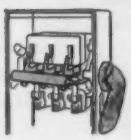

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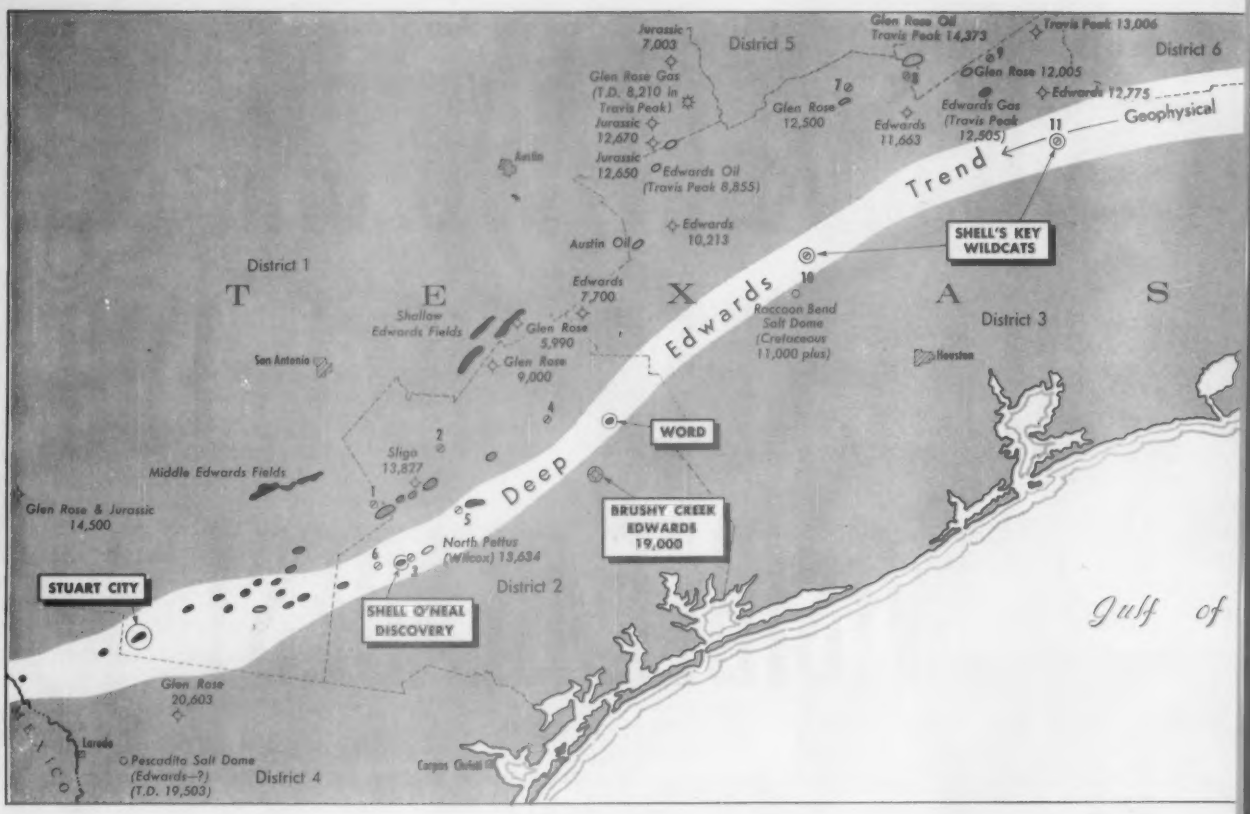

Gulf Coast Girds for New Era in Oil

• Reef concept is going to touch off epic deep-drilling campaign. Hundreds of wildcats will be needed to trace Cretaceous surface along 700-mile trend.

Frank J. Gardner
Exploration Editor

AFTER 60 years of punching holes in soft-rock Tertiary formations, oil finders of the Gulf Coastal Plain now face a hard-rock challenge. And it may dwarf anything they've ever faced before.

The region stands at the threshold of a new era of deep exploration. It will exceed in footage and importance any oil-finding campaign yet launched in Texas. It may indeed be the most important concept since the introduction of the electrical log.

This means REEFS. There was a day when the word was completely foreign to the Gulf Coast oil finder, but now it's becoming an every-day expression.

Only recently has this concept occupied Gulf Coast oil men, for the idea of deeply buried Cretaceous reefs was pure theory until a few years ago. In 1954, theory became fact as Stanolind Oil & Gas Co. (now Pan American Petroleum Corp.) completed its 1 Martin as the discovery well of Stuart City field in LaSalle County, Texas. The well cut approximately 1,000 ft. of Edwards reef and was completed for 5½ million cubic feet of gas at 10,100 ft.

Existence of the deep Edwards was no secret. Earlier wells had found it. But only one well had been completed in it, and the producing rock was not reef rock. This was Humble Oil & Refining Co.'s 1 Gubbels, deep 1953 opener at San Miguel field, McMullen County. It was a billion-cubic-foot producer from Edwards at 10,150 ft., 50 miles northeast of Stuart City. San Miguel proved to be a salt dome.

These two wells climaxed the earlier search in LaSalle and McMullen counties which had seen several troublesome Edwards explorers fail. Two of these were blowouts, and they actually signaled events of the future.

After Stuart City was found, a chain reaction of deep exploration was set in motion across the brush country of LaSalle, Webb, McMullen, and Live Oak counties. A dozen more Edwards fields were opened along the trend. But lack of pipeline connections slowed the play and delayed development.

Fashing strike . . . The strike that really blew the lid off for deep Edwards drilling occurred in 1956 at Fashing in eastern Atascosa County. Lone Star Producing Co. finished its 1-A Urbanczyk for 36 million cubic feet of gas and 855 bbl. of

Active Wildcats Along Reef Trend

No. on Map	Well Name	County	Target Depth	Status
1	Carrl & Auld 1 Campbell	Atascosa	11,000 ft.	Drilling at 7,764
2	Thomas Drilling Corp. 1 Kotara	Wilson	9,000	Drilling at 5,858
3	Shell 1 Tomasek	Bee	16,000	Drilling at 14,896
4	Harkins et al. Kelley	Gonzales	13,000	Drilling at 11,811
5	Socony Mobil 1 Meyer	Karnes	9,700	At 9,728; preparing to test
6	Tenneco 1 Alamo Lumber Co.	Live Oak	15,500	Coring at 14,330
7	Lone Star 1 Johnson	Madison	11,000	Rig up
8	Pure Oil 1 Alliance Trust	Madison	11,125	Drilling at 10,881
9	Humble 1 Moore	Trinity	10,500	Drilling at 9,650
10	Shell 1 Chapman	Waller	20,500 (Sligo)	Drilling at 5,400
11	Shell 1 Southland Paper	Polk	14,500	Drilling at 8,400

Hunting

liquids per day (open flow). Production came from the Edwards limestone at 10,790 - 10,816 ft. and 10,824-50 ft. Cores revealed 580 ft. of good to fair porosity and 69 ft. of poor porosity in the Edwards.

With that discovery, the best in South Texas in a decade, the Edwards play was really on.

But how far has it progressed, and how far has it yet to go? These are the questions that occupy Gulf Coastal geologists today.

The Fashing discovery ignited a play in Atascosa, Karnes, and Gonzales counties that has revealed a string of fields some 50 miles long. These produce not from reef, but from structural and stratigraphic traps involving complex faults and facies changes.

The reef trend lies to the southeast at much greater depth and now stretches across at least 200 miles of Southwest Texas brush land. It received its northernmost impetus only recently when Socony Mobil Oil Co., Inc., completed its 1 Kahanek, which discovered Word field (see map).

This discovery cut 1,000 ft. of Edwards reef and finished at 13,320-14,278 ft. for 15 million cubic feet of gas per day. It went to a total depth of 14,361 ft. The discovery lay 50 miles northeast of the nearest other Edwards field, and no discovery has yet taken place in this gap.

Northeast stretch . . . Testing the theory that this trend could extend clear across Texas and Middle Louisiana are two extremely important wildcats now on the way down. These are both Shell Oil Co. operations.

In Waller County, Shell 1 Chapman (10 on map) will go to 20,500 ft. for a look at the Sligo, a member of the Glen Rose formation which lies even deeper than the Edwards. In Polk County, Shell 1 Southland Paper Mills, now moving in tools, is scheduled for 14,500 ft., obviously aimed at the same Lower Cretaceous target (11 on map).

These two important wildcats show that coastal operators are thinking well ahead of the times.

"Why stop in the Edwards?" many South Texas geologists ask. For below the Edwards lie those prolific East Texas reservoir rocks of Trinity age: the Paluxy, Rodessa, Pettet, and Travis Peak. And what about the Jurassic, even deeper?

These are just questions, and they are couched in geologic theory at the moment.

But there is plenty of evidence that the theory is sound. The recent revelation of reefs in the East Texas district in Anderson and Henderson counties, plus earlier discoveries in Lower Cretaceous rocks along the boundary line between Railroad Commission districts 3 and 6, lends credence to the belief that these reservoirs do project coastward into the heart of District 3.

Land men at work . . . Add to all this a white-hot lease play and geophysical option-taking across the oil-barren band circling Central Louisiana, and there is reason to believe that the coastal plain is in for an entirely new type of campaign, stretching from Mexico to Mississippi.

In recent weeks this lease play, predicated on the possibility of Lower Cretaceous reefing along a line from Fort Trinidad field (on the Madison-Houston county line in Texas) due east to the Mississippi River, has engulfed Trinity, Polk, Tyler, Jasper, and Newton counties in Texas, and swept across Vernon, Sabine, Rapides, Avoyelles, Catahoula, and Concordia parishes in Louisiana.

In the space of a few weeks, majors and independents alike leased more than half a million acres on the Louisiana side alone.

Principal majors taking part in the leasing spree are Pan American, Sinclair, Continental, Sun, Shell, Humble, and Placid. Independent brokers are active too.

Some majors are signing 6-month to 1-year geophysical options. As a rule, these pay $1 per acre and minimum selection of acreage for

Ramsey Will Take Culberson's Place

TEXAS Lt. Gov. Ben Ramsey last week was appointed to the Texas Railroad Commission by Gov. Price Daniel.

The move came as a surprise to many people, although Ramsey's name had figured earlier in speculation about a successor to the late Olin Culberson.

Some were quick to label the Ramsey appointment a "political trade out" and to predict Ramsey will have tough sledding ahead.

Ramsey played a key role in passing some controversial new election laws through the recent special session of the Texas Legislature. These laws are regarded by Daniel as vital.

The legislation passed only because Ramsey cast a tie-breaking vote in the state Senate.

Ramsey will be required to stand for election for the remainder of Culberson's unexpired term. He will have to do this in the general election next year. And he will have to run again in a couple of years, when the Culberson term expires.

final lease at rates of $5 bonus for 10-year lease and $2.00 rentals. Brokers are signing 5 to 10-year commercial leases at $1.50 to $5 per acre.

On the Texas side, the lease play is just as brisk, but figures on amount of acreage signed are not available. Shell, for example, is said to have spent over a million dollars on Texas leases since January 1960.

Following its deep Edwards discovery at the 17,000-ft. 1 O'Neal in Bee County (see map) last spring, Shell's interest spans the entire coast. The company has signed contracts in Colorado, Austin, Waller, Grimes, San Jacinto, Tyler, and Polk counties; it holds about 40,000 acres in Polk County alone.

Not all roses . . . It's an expensive play, but success means a rich reward from Edwards producers.

Most operators figure on a 4-year payout. Wildcat costs run from $100,000 to $200,000, and field wells average $200,000.

Despite a fair ratio of producers to dry holes (about 25%), some of the best prospects have been dry. A good example was Union Producing Co.'s recent completion at its NPR-Ray in Bee County's North Pettus field.

The test laid "on trend" and downdip from Shell's strike at 1 O'Neal (see map), but Union reached total depth of 13,634 ft. without reaching the Edwards, which most observers believed to be Union's target. The O'Neal well produced from Edwards at 13,671 ft. Union finished the 6 NPR-Ray in basal Wilcox sand as a gas well.

The Wilcox, incidentally, is a possible windfall for Edwards failures all along the trend, from the Rio Grande to the Mississippi.

Deepest failure along the trend so far was Hunt Oil Co.'s 1 Walker in eastern Webb County; this one went to 20,603 ft. and bottomed in Glen Rose.

Early cues were ignored . . . Edwards hunters now are indulging in a lot of hindsight, for actually Lower Cretaceous oil is no stranger to the Gulf Coast. These early occurrences should have been the tipoff to bigger things ahead.

Edwards oil was found in Lee County's Tanglewood field at 6,300 ft. back in 1948 by Humble. Glendale field in Trinity County produced Edwards gas in 1946 at 10,500 ft. The discovery of Edwards oil at Chreisman in Burleson County in 1938 was hailed in print as "the forerunner of deep Edwards production throughout the Texas Gulf Coast," but for 16 years nobody paid any attention to the prospects.

In 1948, Milam County's Gause field paid off with Edwards oil at 5,700 ft., and 5 years later the same field yielded dual production of gas from Glen Rose at 6,300 ft. and Pettet at 7,700 ft. This is still the southwesternmost occurrence of pre-Edwards production in the region.

The events along the trend today only foreshadow what lies ahead. At the far southwest corner of the map, note Shell's discovery of Glen Rose and (more importantly) Jurassic sediments to depths of 14,500 ft. This occurrence, plus three finds of Jurassic sediments at 7,000 to 12,670 ft. in Milam County, holds special significance in view of the current Jurassic boom in the East Texas embayment. It is reasonable to assume that in years to come, the Jurassic belt of production will sweep entirely across the state to the Rio Grande.

Structurally, those who would search for Lower Cretaceous and Jurassic production have myriad targets.

Edwards production has come from salt-dome uplifts, from flexures, faults, and folds, from facies-change strat traps, as well as from reef traps. The confirmation of the huge Pescadito structure east of Laredo as a salt dome, deepest in Texas, stemmed from a 19,500-ft. Edwards wildcat. It failed in the Edwards (there are those who doubt it was even reached), but production was established from the Wilcox. The Raccoon Bend salt dome in Austin County (upper Gulf Coast) has yielded Cretaceous rocks from below 11,000 ft.

Hence, the implications of Edwards traps on the flanks of many Gulf Coast and East Texas salt domes are obvious.

Job No. 1 is to feel out the Cretaceous surface, especially the hard-rock Comanchean surface. To outline its phantom face in the subsurface will require hundreds of deep wildcats.

Geologically, it's hard to imagine the number of exploration possibilities that lie ahead in this part of the country. The stratigraphic section is replete with major unconformities, and each one masks a completely new set of structural conditions about which practically nothing is known today.

Such unconformities separate the Tertiary from the Upper Cretaceous, the Upper Cretaceous from the Lower, and the Lower Cretaceous from the Jurassic. In a verticle sense, there exist at least three completely unknown geologic provinces that will require exploration in the future.

As one prominent South Texas geologist put it: "What does southern Arkansas have that Southwest Texas doesn't have to produce another Magnolia or Schuler field from the Jurassic?"

And he put that question in 1948!

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Competitive Price Posted for Zelten Crude

- Price set at $2.21 as Esso fills 30-in. line to move crude to market.

A PRICE tag of $2.21 per barrel has been put on Esso Libya's Zelten crude—a price the company believes is squarely in line with posted prices in the Persian Gulf.

The posting by Esso International, Inc., came on the heels of the welding of the last joint of Esso's 100-mile 30-in. pipeline linking the company's big Zelten field to a Mediterranean port at Marsa el Brega.

Esso decided on the price without consulting Libya's Petroleum Commission, a prerogative of the company, which under its original concession agreement covered by the 1955 Petroleum Law is not required to post prices. But the government was notified of the move immediately after the posting.

Pipe filling has already begun on the line to the coast. The Jersey Standard affiliate says it will take at least a month to fill the line at the rate of 25,000 bbl. daily.

Actual opening and full operation of Port Brega terminal is not expected until later this year. Esso has not yet finished terminal storage nor a 5-mile, 48-in. pipeline to link the terminal with actual loading facilities. But some deliveries to tankers through temporary facilities will be available before the permanent installations are completed.

Pipeline fill will be conducted with temporary facilities for stripping gas from Zelten crude. Permanent gas-separation equipment is now being installed.

Competes for Europe . . . The $2.21 posting for the 39° to 39.9°-gravity oil was set to compete with existing postings at Persian Gulf terminals.

The crude has advantages of a short tanker haul to Europe, its natural market, and a low sulfur content. Its disadvantages are its high gravity and high wax content. This is because light crude does not automatically command a higher price in Europe, where the fuel-oil yield of refineries is normally more than 40%, and where light ends are a problem. The wax content in the natural fuel-oil cut from Zelten crude is so high that the product will not flow at 100° F.

LIBYAN crew works on 100-mile, 30-in. pipeline—now completed—which will carry Libya's first commercial crude from Zelten field to Mediterranean.

Neighboring postings . . . While the Zelten posting seems low in comparison with other Mediterranean prices, other factors are involved.

The posting at Sidon, the Mediterranean terminal of Tapline, at $2.17 per barrel for 34°-gravity crude, high in comparison with Port Brega considering the longer tanker hauls involved, in reality is overpriced and has few takers.

Deliveries from Sidon fell 35%

Esso Will Forego Any New Libyan Acreage

ESSO LIBYA says it has no plans to convert its present concessions to the terms of Libya's revised oil law.

This means the company will stick to the terms of its original agreement with Libya, and forego any chance to win more exploration acreage in the future.

The amended law, which needs only formal publication in the official gazette to become effective, forbids present concession holders from bidding on acreage in the future unless existing concessions are voluntarily converted to the new rules within 6 months.

The changes sharply increase fees and rents on acreage, eliminate the depletion allowance, and provide that posted prices, rather than market prices, serve as the basis for figuring an operator's income (OGJ, Aug. 7, p. 100).

the first 7 months to 234,000 bbl. daily, less than half of Tapline's capacity. Saudi Arabian crude production in the same time has averaged around a record 1,400,000 bbl. daily, with Ras Tanura handling increased crude exports.

The reason is that current low tanker rates enable crude purchasers to gain an advantage of several cents per barrel in picking up the same type of crude at Ras Tanura, rather than at Sidon.

Another Mediterranean posting, for Hassi Messaoud crude, at $2.65 for 40°-and-higher-gravity crude at Bougie, Algeria, reflects French Government control over imports into the big French market. The government can force refiners in France to take French Saharan oil at any price it wishes, within reasonable limits. But this posting is unrealistic in other markets. Hassi Messaoud crude in one case was offered in Latin America at an f.o.b. price of $2.15 without winning the sale.

Discounts probable . . . Initial shipments to Jersey affiliates, largely on a trial basis, will almost certainly be based on posted prices.

But discounts are almost certain to be made later to third-party customers. This especially may be true when other companies bring large volumes of Libyan oil into the market later.

Mobil Gets Good Oil Producer on Second Test in Maracaibo

MOBIL International has brought in a 3,860-bbl. daily well on its second try for production in Lake Maracaibo.

The company encountered the flow of 31.2°-gravity crude in its MOB 349.1 on a test through a ¾-in. choke. The well was bottomed at 12,090 ft. in the Guasare formation. Production is from the C-1 Eocene section.

The well is in the southern portion of a 11,416-acre farmout in the mid-lake area from Creole Petroleum, and is about ¾-mile south-southwest of a capped producer drilled by Creole. Mobil's third well on the tract, the 347.1, is drilling ahead at 8,892 ft.

Kuwait Starts New Pipeline

KUWAIT'S youngest oil field will have a 100,000-bbl. pipeline outlet in operation by May 1962.

Kuwait Oil Co. is laying a 30-mile 22/24/26-in. pipeline from Minagish field to Mina al Ahmadi tank farm. The 100,000-bbl.-daily capacity will be achieved with gravity flow, and can be increased later by the installation of pumping facilities.

The joint Gulf Oil-British Petroleum Co. has said little about Minagish since the discovery well came in as a producer from the Ratawi limestone formation 2 years ago. Pay is between 9,000 and 10,000 ft.

On early tests, Minagish 1 flowed 1,660 bbl. daily through a ⅝-in. choke from a 5-ft. perforated interval. Flowing pressure was 600 psi. The crude is about 34.5° gravity, with a sulfur content of about 1.9%.

Production from existing wells is about 10,000 bbl. daily and is moved out through temporary facilities. Three additional wells have been scheduled for this year.

Iraq Petroleum Talks Resume

. . . this week after 4-month recess. Company stands fast on refusal to make Iraq Government a partner.

THREE important oil meetings will be held in the Middle East in the next 2 months, and the scheduling of one of them has caused the raising of a few eyebrows around the oil world.

First of the sessions will be the resumption of talks between the Iraq Government and Iraq Petroleum Co. The new IPC negotiating team, led by H. W. (Duke) Fisher, a director of Jersey Standard, and including F. J. Stephens, chairman of Shell Transport & Trading, and G. H. Herridge, IPC managing director, has been invited by Iraqi Oil Minister Mohamed Salman to renew talks in Baghdad on August 24.

The IPC negotiators will seek to reach a new concession agreement after 4 years of off-again on-again talks that have been in progress since Premier Kassim staged a successful revolt in 1957.

The latest sessions broke down on April 16 over a deadlock on the issue of "dead rents" on concession areas. Iraq objected to IPC's practice of amortizing these rentals at 5% per year. Both sides agreed to arbitration, but Kassim angrily called off the talks because IPC refused to suspend the practice pending a decision by arbitration.

IPC subsequently made two conciliatory moves. These were the appointment of the new negotiating team and suspension of write-offs of "dead rents" pending arbitration.

But one of the chief stumbling blocks to a new Iraq-company agreement still needs to be settled. This is Premier Kassim's insistence that Iraq be allowed to subscribe to at least 20% of the company's capital stock. IPC's argument is that it has never issued stock and its ownership is fully subscribed.

Other issues in dispute are surrender of concession areas, use of natural gas, and a bigger share of profits for Iraq (OGJ, July 3, p. 97).

Arab, OPEC meetings . . . A puzzle has been raised by another important conference, the meeting of the Organization of Petroleum Exporting Countries.

This has been rescheduled to start October 21 after postpone-

ment from the original August 19 date at the request of Iraq. The change was made to avoid a conflict with the coming IPC talks in Baghdad, although there is little doubt that animosity between Kuwait and Iraq also played a part in the delay.

The October date, however, creates a second clash, this time with the Third Arab Petroleum Congress scheduled to start in Cairo a few days earlier. This has led to speculation as to why an OPEC date was timed to force many Arab and other luminaries, who could normally be expected to attend both sessions, to leave Cairo early.

Murban, Umm Shaif Reserves Figured at 3.5 Billion Barrels

ADD another 3.5 billion barrels to reserves in the Middle East.

This is the estimate of the combined recoverable reserves in two young fields under commercial development in Abu Dhabi, a shaikdom on the Trucial coast along the southern side of the Persian Gulf.

Victor de Metz, chairman of Cie. Francaise des Petroles (CFP), stated that the combined recoverable reserves of Umm Shaif offshore and Murban onshore oil fields are currently estimated at 500 million tons—or about 3.5 billion barrels.

He said CFP's share of production from the two fields will total 4 to 5 million tons per year, or about 80,000 to 100,000 bbl. daily.

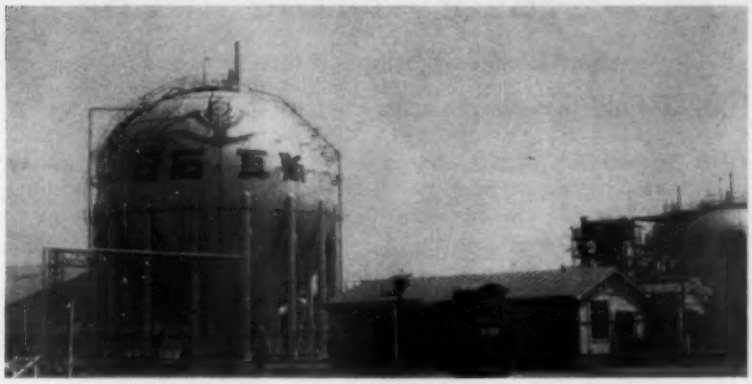
CFP will have 23¾% of the output from Murban through its interest in Petroleum Development (Trucial Coast) Ltd., an Iraq Petroleum Co. affiliate, and one-third interest in production from Umm Shaif through its interest in Abu Dhabi marine areas. British Petroleum holds the other two-thirds interest.

Umm Shaif probably will be put on commercial production first.

At least four wells have been drilled since the initial find came in as a 2,400-bbl-daily well in 1958. The 40°-gravity oil is from a Lower Cretaceous limestone at 5,500 ft. A 20-mile submarine pipeline is being laid to link the wells with terminal facilities on Das Island.

Murban field, only 10 miles from the Persian Gulf coast, is 5 years older than Umm Shaif, and has more wells. But Petroleum Development took a longer look at the field before deciding it was a commercial proposition.

Two oil wells have been completed on the north-south structure that extends for at least 15 miles. Three wells on the east, west, and south flanks have been completed as oil-water observation wells. One test is a gas observation well.



Japan Gets Ready for LPG Imports

ONE of the world's largest pressurized propane storage tanks has been built at Kawasaki, Japan, in preparation for large-scale imports of refrigerated LPG from the Persian Gulf.

The 1,000-metric-ton (530,000-gal.) capacity tank was built by Nippon Oil Gas Co., the LPG marketing arm of Nippon Oil Co. This is a Caltex affiliate which expects to start bringing in refrigerated LPG from Saudi Arabia's Ras Tanura refinery early next year.

The new spheroidal tank was built for $195,000, or about $195 per ton of storage, reportedly half the cost per ton of capacity of smaller, conventional LPG tanks in the area. It has a design working pressure of 235 psi., and an inside diameter of 51 ft. 10 in. A special high-tensile strength steel of about 1.2-in. wall was used.

Nippon Oil also is building an 80,000-bbl. tank to take refrigerated propane, and a 40,000-bbl. tank to take refrigerated butane at Kawasaki.

Colombia Has New Field

A NEW discovery has been made in the Cicuco area of North-Central Colombia by Colombian Petroleum Co.

The find by the jointly-owned affiliate of Socony Mobil and Texaco tested 348 bbl. daily of 41.2°-gravity crude on a 3/16-in. choke. The wildcat, about 5 miles southeast of Cicuco, was drilled to a total depth of 8,086 ft.

Additional drilling will be needed to determine the significance of the find. Cicuco oil field, found by Colpet in 1956, is one of the best in Colombia, with output of 25,000 bbl. daily from the 8,000-ft. range.

Mobil Plans Wildcat Program in Barinas Basin of Venezuela

MOBIL Oil Co. de Venezuela is going to look for more oil in the Barinas basin of western Venezuela.

The company has acquired 47,600 acres of concessions in Barinas from Esperanza Petroleum Corp.

The agreement gives Mobil the right to drill wildcat wells and, if successful, to develop production in the undeveloped acreage. Esperanza, owned 68% by Amerada Petroleum Corp., has invested $4 million in the acreage so far.

The Esperanza acreage lies within a few miles of the 209-mile 20-in. pipeline to El Palito on the Caribbean coast. The pipeline, jointly owned by Mobil and Sinclair, moves Barinas production of 70,000 bbl. daily to the coast.

New Discovery Made in Chile

• Government company brings in three producers east of Daniel field just as the area gets its first pipeline.

CHILE has celebrated the opening of a pipeline outlet from its youngest and possibly best oil field with another new discovery to the east.

The new find, Daniel Este 1, about 4½ miles east of Daniel field, and two successful stepouts, have been brought in almost coincidentally with the opening of a 50-mile 8-in. outlet from Daniel itself.

All three new wells are in the 500 to 800 bbl. daily class, producing 35°-gravity, waxy crude from about 6,000 ft. On actual production, the government company, ENAP, will probably hold the wells at 200 to 300 bbl. daily.

The first stepout, Daniel Este 2, is about 0.6-mile north of the discovery. No. 3 is nearly 2 miles east.

Daniel Este marks further success by ENAP in its program to develop crude supplies on the southern tip of South America, opposite its established production on Tierra del Fuego.

Daniel field, discovered in June 1960, already has 35 producing wells. Another field well, is a gas producer. There are only two dry holes. ENAP, while it plans to discontinue development drilling for the time being, still has more locations, especially for directional wells to pay under the Straits of Magellan.

These wells, most of which will be produced with a flow rate of 200 to 300 bbl. daily, have been put on production with the opening of a line which ties into a 35-mile 8-in. line from Faro Este oil field to a tanker terminal at Gregorio, on the Straits of Magellan.

New Daniel production was largely responsible in a jump of Chilean output from 24,100 bbl. daily in June to 26,900 bbl. daily in July. Of this amount, about 17,000 bbl. daily was produced on Tierra del Fuego, and the rest on the mainland.

ENAP has drilled 49 wells throughout Chile so far this year.

Japan Rejects Another Soviet Oil Deal

JAPAN has turned down a trade offer by Russia that would have paved the way for a crude pipeline across Siberia to the Sea of Japan and opened the floodgates of soviet oil exports to the country.

Eisaku Sato, Japan's Minister of Industry, told the top soviet export salesman, First Deputy Premier Anastas Mikoyan, that Japan is not yet ready to sign a pact that would provide for a sharp rise in the oil and other trade between the two.

Mikoyan had offered to exchange large quaitities of Russian crude, coal, and iron ore for manufactured products in an agreement that would run for more than 10 years.

Mikoyan promised that if Japan concluded the deal for Russian oil, a pipeline would be extended to Nahotska, a port city on the Sea of Japan. Japanese pipe in all probability would have been used in the project, which would be an extension of the 2,300-mile 25.5-in. system now nearing completion from the Second Baku producing area to Irkutsk, on Siberia's Lake Baikal.

Russian oil sales to Japan already are on the rise, but the volumes involved are on a much smaller scale than sought by the Russians. Iron Curtain countries shipped about 35,300 bbl. daily of cheap crude to Japan the first quarter of the year, up from about 21,370 bbl. daily. The Russians last year also sold almost 3,000 bbl. daily of fuel oil to Japan.

FOREIGN BRIEFS . . .

A new 20,000-bbl.-daily Platformer will be the largest unit built at Abadan refinery since the Iranian oil consortium was established 7 years ago. The $10-million unit is scheduled for completion in April 1962. British and Dutch subsidiaries of Fluor Corp. of Los Angeles are responsible for mechanical design and construction.

Construction has started on a 316-mile, 6-in. products pipeline network linking Syria's 20,000-bbl. Homs refinery with Aleppo, Damascus, and Latakia. The system is being laid by Technit, an Italian firm, which expects to complete the project in about 16 months. Cost of the line will be about $7 million.

Polypropylene film and film products will be manufactured in the United Kingdom by a company to be formed by Metal Box Co., Ltd., and Shorko, Ltd., a joint Shell and National Distillers & Chemical firm.

A 20,000-bbl. refinery to be built in Tunisia by ENT will be located at Bizerte, rather than Laskhira as originally planned. Laskhira is the Mediterranean terminal of the CREPS crude pipeline from the Edjele producing area in the French Sahara.

A new group of synthetic organic acids will be produced on a commercial scale by Shell in the Netherlands, starting in January 1962. The acids, to be marketed under the name "Versatic," will have applications in surface coatings, plastics, rubber, metallurgical, and other industries. Products will be produced at a $5.6-million unit under construction at Pernis (Rotterdam).

A 6,000-bbl. houdriformer has been put on stream at Nippon Mining Co.'s 40,000-bbl. refinery at Mizushima, Japan. The installation takes high-paraffin, high-sulfur naphtha derived from Middle East crude and transforms it into a desulfurized 95 clear octane gasoline.

The name of Panama Refining and Petrochemical Co. has been changed to Golden Eagle Refining Co. of Panama. The firm, subsidiary of Ultramar, a British holding company, plans to build a 55,000-bbl. refinery in Panama.

Servicing the Herron No. 1. This servicing unit, owned by McKaig Well Servicing Company, Crescent, Okla., was photographed as preparations were being made to reperforate the hole at the Herron No. 1, located near Hunter, Okla. The unit was rigged with 7,000 ft of Bethlehem 9/16-in. 6 x 7 sand line with plastic core, and 8,000 ft of Bethlehem 3/4-in. 6 x 19 drilling line with fiber core. Bethlehem Wire Rope, because of its ruggedness and ease of handling, is ideal rope for servicing units.

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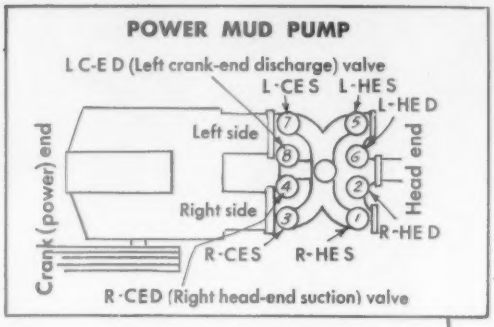
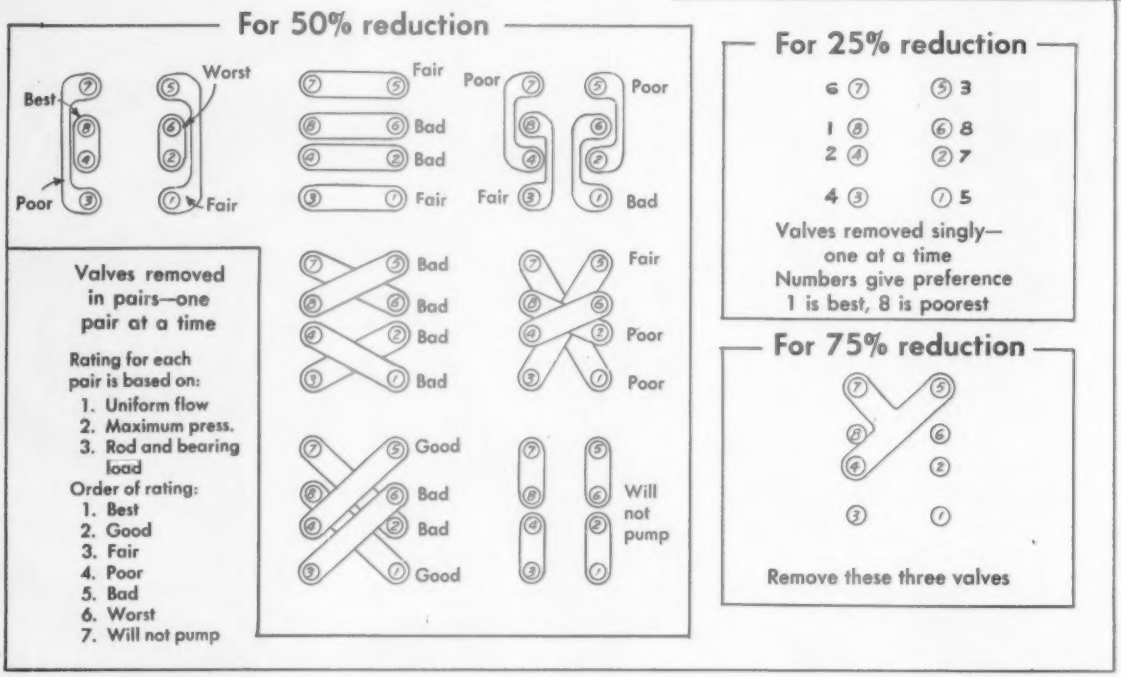
Is "running on one side" the best way to operate a mud pump when you want less than normal volume from it? While it has some advantages, it is harder on mud-pump parts than other modes of operation. Here is a thorough analysis of the best—and worst—ways to run a mud pump for low output rates.





ROD LOADS AND PRESSURE SURGES are best kept in bounds by using the valve-removal recommendations above. Best way to cut pump delivery in half is to remove both crank-end discharge valves while using smallest pistons. Fig. 1.

How you can get

Smaller volumes from standard mud pumps

BY WALTER E. LILJESTRAND
Mission Manufacturing Co., Houston

ON MANY occasions during drilling, it is necessary to cut down the volume of mud the pump delivers.

In such cases, it is always best to reduce pump speed, if possible. Doing this is simple; pattern of flow, and the pump runs smoothly.

Second-best method is the normal changeout of pump liners for a smaller size. For instance, replacing a 7½-in. liner with a 4½-in. liner reduces volume delivered by the pump by two-thirds.

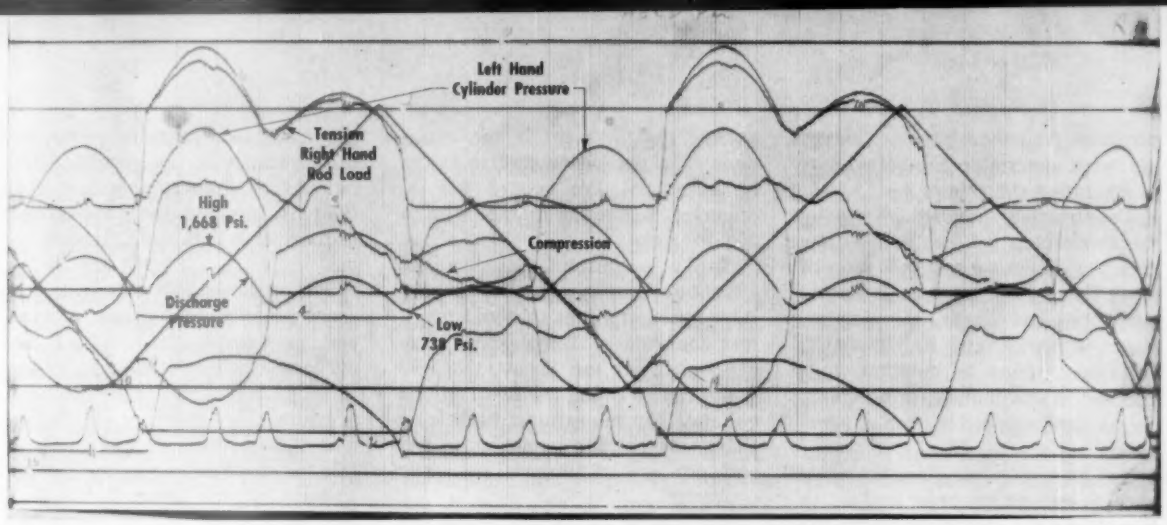
Now, what is to be done if volume must be reduced even further than possible by slowing the pump or by changing liners? Normally, the practice is to remove one or more of the valves. For example, volume is cut in half if the suction valves on one side of the conventional mud pump (duplex, double-acting) are removed.

It is possible to remove valves in many different combinations. In fact, pairs of valves can be removed in 28 different ways. The question is: which way is best?

Fig. 1 answers this question. From the diagrams, you can find how to cut volume in three different magnitudes. Removing a pair of valves reduces flow approximately 50%. A single valve removed results in 75% normal flow. Removing three valves cuts flow to 25% of normal.

. The best way to reduce pump volume is by removing both crank-end discharge valves while using the smallest pistons. Reason is that flow rate and discharge-pressure surges are almost normal. Maximum rod load is only 16% greater than for the normal pump; it is only 58% of the load when running "on one side" of the pump.

If only one valve is to be removed, the order of preference is: (1) crank-end discharge, first choice; (2) crank-end suction, second choice; (3) Head-end suction, third choice;



OSCILLOGRAPH RECORD of mud pump in normal operation follows closely shape of theoretical curves. As a result, pressures and flows in this study are those predicted from calculated curves in succeeding figures. Fig. 2.

(4) head-end discharge, last choice.

Basic questions. To understand why the arrangements are rated from best to worst, we must learn the answer to these questions:

1. What effect does removing a valve, or valves, have on the pressure curves caused by the remaining piston strokes?
2. How are rod load, horsepower, and maximum pressure affected?
3. Which pattern of valve removal is best?

Pump manufacturers issue with each pump a table to list rated volume, pressure, and horsepower for each liner size and pump speed. In these ratings, the manufacturer tries to keep rod load and bearing load constant through all liner sizes. So, in removing valves, we must make certain we do not exceed the rod load recommended by the manufacturer.

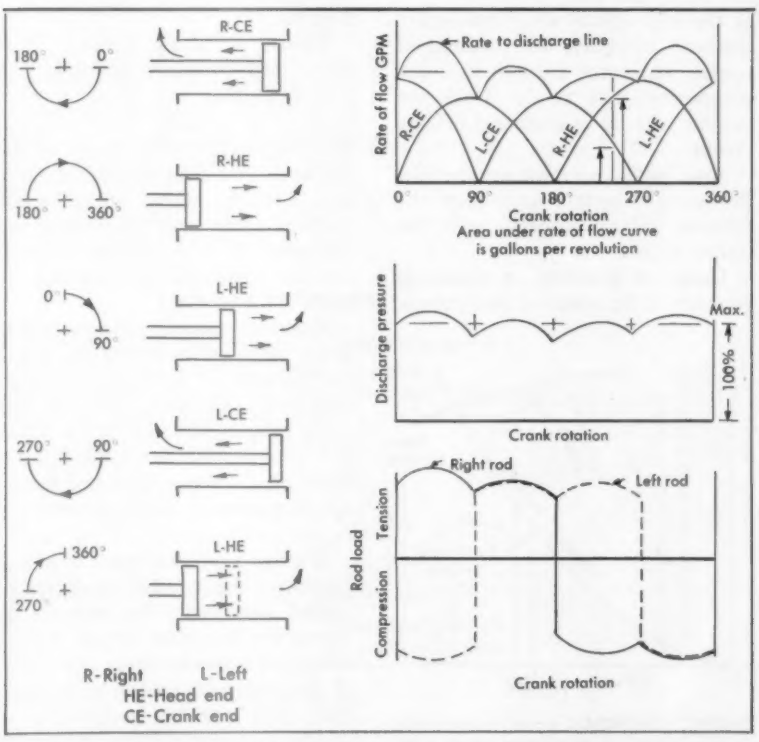
The higher the rod load, the shorter the life of the power end of the pump.

In the field, the final test of any plan for removing valves is whether the pump operates satisfactorily, as determined by the operator. However, to judge among similar plans, we need more information than we can get from field testing. While it would be good to take oscillograph readings of discharge pressure and rod load, this much effort is impractical and unnecessary.

We already have some oscillograph tests we can use. Fig. 2 shows one. This is a record for normal pump operation and shows principally discharge pressure, cylinder pressure, and rod load. There are four peaks each revolution; in this case, cylinder pressure surges from a low of 738 psi. to a high of 1,668 psi.

The shape of the cylinder-pressure diagram duplicates a portion of the discharge-pressure diagram, though to a slightly different scale. Shape of the rod-load diagram duplicates the cylinder-pressure diagram for each successive stroke—first tension and then compression. This relation between the curves is what you would expect.

We have few oscillograph records of discharge pressure for a pump running with one or more of the valves removed. Such records aren't necessary. We can predict discharge pressure from the rate of flow of mud from successive piston strokes; discharge pressure is proportional to the square of rate of flow. The 1,668-psi. pressure peak we see in Fig. 2 was caused by a high rate of flow from the pump; the 738-psi. low point results from a lower rate of flow. Such changes in the rate of flow during the pump cycle are what determine the surges in



RIGHT AND LEFT-HAND PISTONS in making their strokes, at left, result in flow, pressure, and rod loads shown at right. Left crank is 90° behind right so that strokes do not coincide. Fig. 3.

pressure. And these pressure surges are what determine the safe limits of operating the pump.

Constructing diagrams. Knowing the above facts, we can easily draw accurate diagrams of the rate of flow. For this we use crank length, connecting-rod length, pump speed, piston diameter, and rod diameter. Fig. 3 contains a diagram constructed in this manner for a duplex, double-acting pump in normal operation.

Let us start by imagining the right-hand piston at its head end as in Fig. 3. As the piston moves to the crank end (0° to 180° in the stroke), it delivers that fluid contained in the cylinder around the rod. Rate of flow during this time increases from zero to a maximum and back to zero at the 180° point. This is because the piston also starts with zero velocity, reaches maximum speed near midstroke, and then stops again at the 180° crank position.

The other right-side stroke is the head-end portion (from 180° to 360°). During this period, the piston delivers more fluid because there is no rod on the head end to take up space.

The left crank is 90° behind the right crank so that the left piston strokes do not coincide with the right ones. As a result, the left piston strokes only half from 0° to 90°. It strokes full from 90° to 270°, and then another half from 270° to 360°.

How can we obtain the total rate of flow delivered by the pump in gallons per minute? We add the rates of flow for the two cylinders as shown at the 240° position.

It is remarkable how well the total-rate-of-flow diagram constructed in this manner compares in shape with the discharge-pressure curve actually measured in a pump (Fig. 2). Because of this excellent comparison, the discharge-pressure and rod-load curves shown in this paper are doubtless fairly accurate, even though they are drawn from calculated rate-of-flow diagrams.

The diagrams and estimates are most accurate when the pump cycle is smooth. They are most difficult when pressure-surges are great.

What we assume. We cannot draw the rate-of-flow diagrams without specifying our conditions. Here, we assume that 7½ in. is the maximum-diameter piston and that 5½ in. is normal. We assume 4½-in. diameter is the minimum with a 2½-in. rod.

Stroke is constant and does not affect our comparisons. We will consider speed constant to avoid needless complexity. Actual speed may be considered the lowest that the pump can be run normally to reduce volume. The pump must be belt or chain-driven for constant speed and not driven through a torque converter.

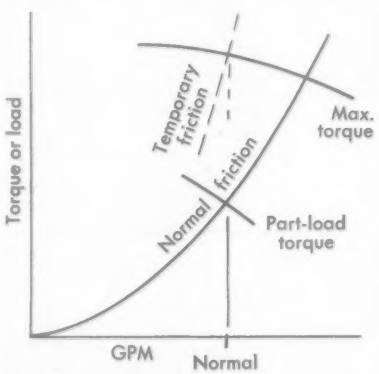
We assume engine and pump are matched in horsepower. That is, when the engine goes to full throttle with enough pump load to keep speed constant, the torque, bearing load, and rod load are at the manufacturer's maximum rating. As a result, the pressure gage reads maximum as specified by the manufacturer for that speed.

Please keep in mind that at full power, discharge volume and horsepower vary with speed changes. Maximum discharge pressure torque, rod load, and bearing load are constant.

We consider that the pump has no pulsation dampener. A good dampener can easily cover up some of the bad effects when valves are removed unwisely. The system, of course, has some natural pulsation dampening that results from the volume of mud in a normal drilling layout.

And, lastly, we must assume that the suction system can keep the cylinder filling properly with the piston stroke.

Cause of pressure. A discharge pressure is the result of two causes:



ENGINE GOVERNOR is set to maintain certain speed; if restriction raises pressure, governor opens throttle and increases rod load, torque, bearing load. Fig. 4.

the rate of flow from the pump, and the resistance in the system to that rate of flow. Pressure increases when fluid is pumped into the system faster than it is flowing through and out.

Fig. 4 shows how an engine governor can increase the fluid pressure and, as a result, the rod load. The curve relates rate of flow to torque, throttle, rod load, and discharge pressure. The governor on the engine delivers enough fuel to maintain the speed setting on the throttle. In this case, the engine would be at half throttle for normal pump volume. It is possible for resistance in the flow system to increase suddenly. The bit might clog, for instance. Then, the friction value would rise from the solid line to the dotted line in Fig. 4. In this case, the governor would move the throttle from one-half to full in order to maintain speed. Torque, rod load, and bearing load would, of course, rise.

The "maximum discharge pressure" given by the pump manufacturer in his ratings is not the "maximum" at all. It is actually the average of the pressure developed at maximum horsepower rating. Fig. 5 shows this on the discharge-pressure diagram.

Causes of pump damage. Rod loads and cylinder pressures can greatly exceed the manufacturer's ratings for a short time with no apparent harm to the pump at the moment. You must remember, however, that the pump life is surely reduced every time the ratings are exceeded. A 26% steady overload reduces expected bearing life to half.

Repeated corrosion-fatigue failure is the result of operating the pump continuously at maximum pressure with mud containing some salt. The stress-fatigue curve in Fig. 6 shows this. Notice that the curve for fatigue life in water does not flatten out as it does for parts stress-cycled in air.

If stress rises as a result of higher pressures, the number of cycles to failure can easily be reduced to one-tenth. In other words, failure comes 10 times as often. The effect of overpressure and bearing overload stays with the pump; it is so serious that all should understand it.

Obvious effects. You need make no complicated analysis to make

several important observations. When you remove a valve from one end of a cylinder, that cylinder is incapacitated. You prevent flow from suction to discharge. If it is the suction valve you take out, that end of the cylinder stays at suction pressure. Other end of the cylinder becomes single acting (as long as all valves on that end are in place).

If it is a discharge valve you remove, the cylinder stays at discharge pressure. Of course, fluid flows in and out of the cylinder from and to the discharge. This flow has an important effect on the flow pattern of the pump.

Essentially, you reduce flow 25% when you remove one valve. Removing two valves reduces flow 50%. Removing three cuts flow 75%.

Area under the rate-of-flow diagram represents gallons delivered per revolution. Area under the rod-load, tension-and-compression diagram roughly indicates torque and horsepower; it would be an exact indication if the abscissa scale were piston motion instead of crank rotation.

You can see that the rod tension in Fig. 3 is less than the compression. Reason is that the effective area of the crank-end side of the piston is less than the head-end size. Difference is the cross-section area of the rod. Of course, the difference ratio varies with the size of the piston diameter and the rod diameter.

Table 1 is for a typical oil-field pump operating normally at constant speed. Listed there are the piston diameters and the maximum discharge pressure that can be reached with the largest horsepower that should be used. Table 1 also shows the piston area. So, it is easy to calculate average tension and compression in the rod for the maximum discharge pressure.

It is common to assume that force on the rod for tension and compression strokes should be equal when they are carrying together the maximum horsepower. As you can see from Table 1, they are not. Notice also that the difference between tensile force and compressive force changes with changes in piston size.

Load vs. pressure. Fig. 7 shows how, at full load, piston diameter is related to maximum discharge pressure and to rod load. Sum of the rod loads added together is 80,000 lb. Notice the curve for the normal rod-load ratio; this curve divides the distance between the abscissa and the 80,000-lb. line in proportion to the rod loads for different piston sizes.

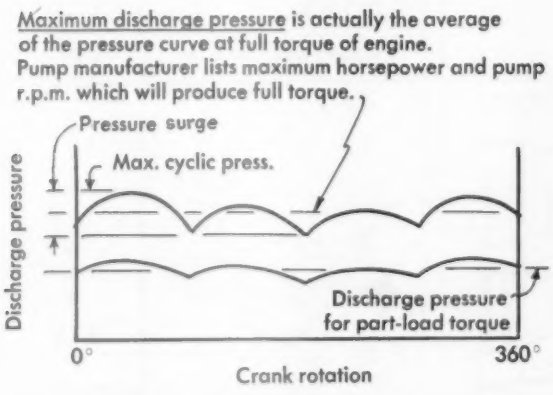
Best balance between strokes is when the largest pistons (7½-in. diameter) are used; then the rod-load ratio is 1.14 to 1. The ratio is poorest (1.46 to 1) when the smallest pistons (4½-in.) are used.

Some pump manufacturers correct their horsepower ratings to prevent overstressing the rod in compression with small pistons. Notice the line on the graph plotted as manufacturer's maximum discharge pressure; this line shows the increase that can be allowed as piston diameter decreases, still keeping constant bearing load. The line extends upward to the absurd but theoretical extreme where piston is reduced to rod diameter, leaving only head-end stroke effective.

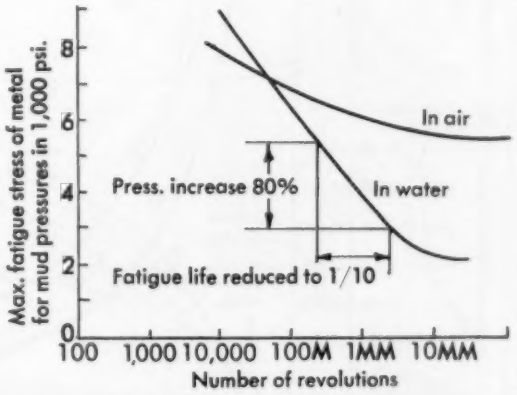
TABLE 1—MAXIMUM PRESSURE AND ROD LOADS, WITH TYPICAL PUMP IN NORMAL OPERATION

Piston diameter (in.)	Maximum-discharge pressure at full torque (psi.)	Effective piston area (sq. in.)		Rod load (lb.)	
		Head end (full face)	Crank end (less rod)	Head-end stroke compression	Crank-end stroke tension
7½	960	44.0	39.0	42,500	37,500
7	1,110	38.3	33.3	43,000	37,000
6½	1,300	33.0	28.0	43,500	36,500
6	1,540	28.3	23.3	44,000	36,000
5½	1,870	23.8	18.8	44,700	35,300
5	2,330	19.6	14.6	46,000	34,000
4½	2,950	16.0	11.0	47,500	32,500
4	4,000	12.5	7.5	50,000	30,000
3½	5,600	9.6	4.6	54,000	26,000
3	8,700	7.1	2.1	62,000	18,000
2½	16,000	5.0	0	80,000	0

Pressure definitions


Maximum discharge pressure is actually the average of the pressure curve at full torque of engine. Pump manufacturer lists maximum horsepower and pump r.p.m. which will produce full torque.
Pressure surge
Max. cyclic press.
Discharge pressure
Discharge pressure for part-load torque
0°
360°
Crank rotation

MAXIMUM DISCHARGE PRESSURE given by manufacturers is not peak pressure but is average of pressure at maximum horsepower rating. Fig. 5.



STRESS-FATIGUE CURVE shows that 80% increase in pressure can cut life to 10%. Note also that curve for fatigue life in water does not flatten out as it does for air. Fig. 6.

C-E-D valves out. Now consider the cylinder in Fig. 8 where the crank-end discharge valve is removed. The cylinder delivers that volume which fills it on the head-end suction stroke. Strangely enough, this volume is not delivered **directly** to the discharge line on the head-end discharge stroke. Instead, most of the volume flows through the pump manifold into the open valve seat of the crank end, filling this end of the cylinder. A small portion of the flow (the amount delivered by the rod area) goes to the discharge line on this stroke.

On the crank-end discharge stroke, the volume around the piston rod is delivered to the discharge line.

This pattern of discharge strokes is shown in Fig. 9 for both right and left cylinders. The pressure diagram is inferred from the rate-of-flow diagram; the rod-load diagram comes from the pressure and the areas effective.

With larger liners. The piston size used in making Fig. 9 was 5½-in. diameter. Figs. 10 and 11 result if the same valves (crank-end discharge) are removed when the liner size is largest (7½-in. diameter) and when it is smallest (4½-in.). It is plain that rate of flow and discharge pressure surge badly with the 7½-in. liners.

The curves are very smooth, however, with the smaller liner.

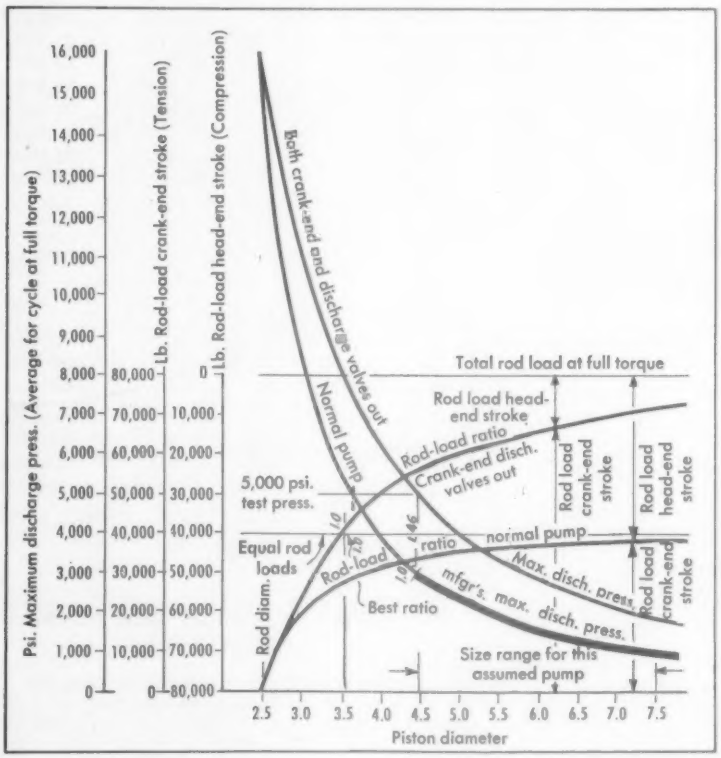
To make further comparison, look at Table 2; it gives actual tension and compressive rod loads with the crank-end discharge valve removed and using the manufacturer's maximum horsepower. These values for rod load are plotted on Fig. 7 as "rod-load ratio with crank-end discharge valves out."

As you can see, with 7½-in. piston, tensile load is 71,000 lb. compared to 9,000-lb. compressive load. The curve in Fig. 7 shows that this poor ratio improves rapidly as piston

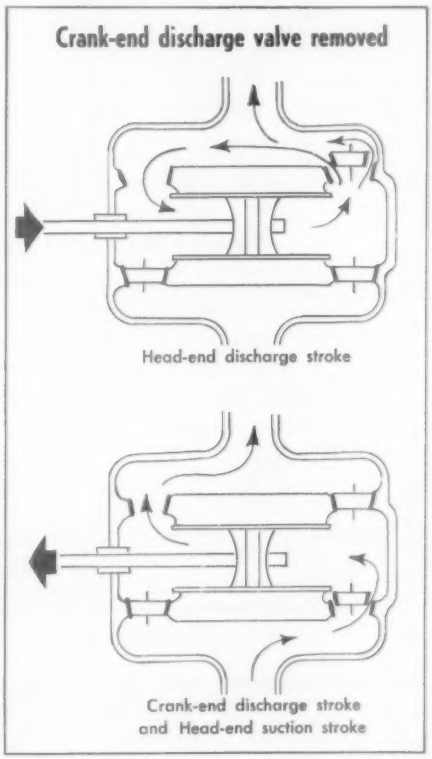
TABLE 2—MAXIMUM PRESSURE AND ROD LOADS WITH CRANK-END DISCHARGE VALVES REMOVED

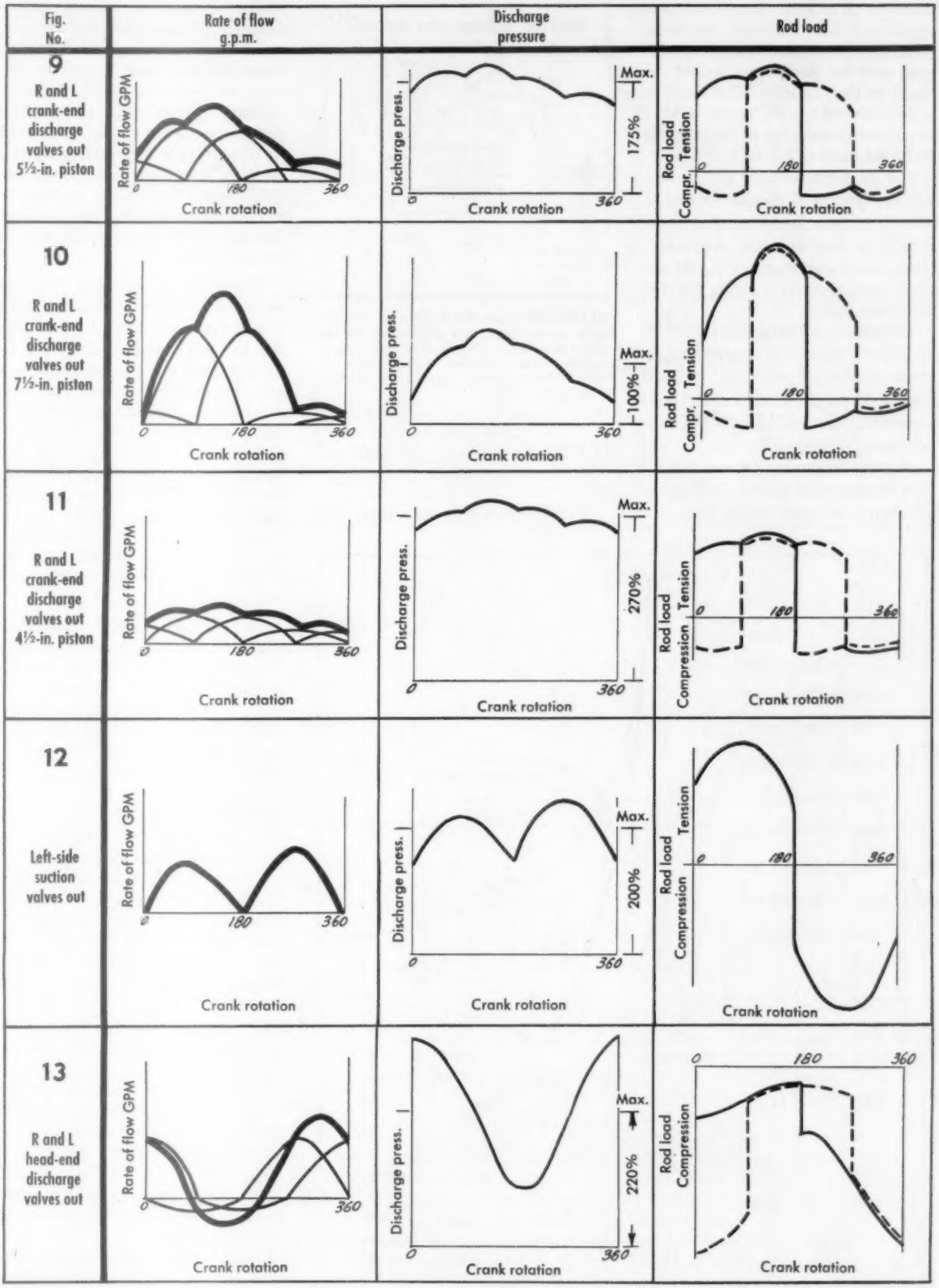
Piston diameter (in.)	Maximum-discharge pressure at full torque (psi.)	Effective piston area (sq. in.)		Rod load (lb.)	
		Head end (rod only)	Crank end (less rod)	Head-end stroke compression	Crank-end stroke tension
7½	1,820	5	39.0	9,000	71,000
7	2,090	5	33.3	10,300	69,700
6½	2,425	5	28.0	12,200	67,800
6	2,830	5	23.3	14,000	66,000
5½	3,360	5	18.8	16,700	63,300
5	4,100	5	14.6	20,000	60,000
4½	5,000	5	11.0	25,000	55,000
4	6,400	5	7.5	32,000	48,000
3½	8,400	5	4.6	41,400	38,600
3	11,250	5	2.1	56,400	23,600
2½	16,000	5	0	80,000	0

BEST BALANCE OF ROD LOADS between head-end and crank-end strokes is when largest pistons are used. In turn, ratio is poorest with smallest pistons. Fig. 7.



FLOW AROUND PISTON is effect when crank-end discharge valve is out; head-end discharge stroke delivers only volume represented by rod area. Remainder of head-end volume is delivered on crank-end discharge stroke. Fig. 8.





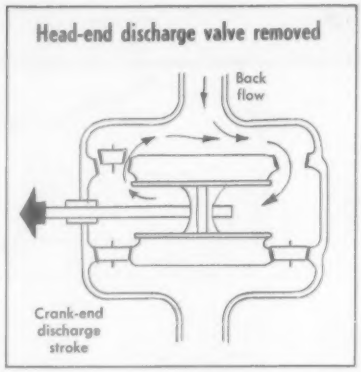
FIVE PATTERNS OF FLOW, PRESSURE, LOAD result from as many situations where valves are removed. Note that rate of flow and discharge pressure are smoothest when the smallest lineers are used and crank-end discharge valves are removed. Figs. 9, 10, 11, 12, and 13.

diameter decreases. Rod loads are equal at 3.6-in. diameter, but such a small piston would be a special case and its back area would be equal to the rod area. The smallest piston offered for the pump is 4½-in. diameter and the corresponding rod-load ratio is 2.2 to 1.

Let us suppose that our pump-engine governor should move to 100% torque because of an increase in discharge-line resistance. Then, discharge pressure would exceed manufacturer's rating by the following ratio:

Maximum discharge pressure with C-E-D valves out = (normal maximum discharge pressure) × [H-E and C-E piston area (normal pump)]/[effective H-E and C-E piston area (valves out)].

As an example, let us take a 5½-in.-diameter piston. Maximum discharge pressure would be:



BACKFLOW from the discharge line results when head-end discharge valves are removed. Volume of crank end is smaller than volume of head end so rate-of-flow curve (Fig. 13) is complicated. Fig. 14.

$$(1{,}870) \times \frac{23.8 + 18.8}{5 + 18.8} = 3{,}360 \text{ psi.}$$

Fig. 7 plots this maximum discharge pressure versus the piston diameter. From this plot, we can make the conclusion, stated earlier, about the best way to reduce volume: by removing both crank-end discharge valves while the smallest pistons are in the pump. With such conditions, flow rate and discharge-pressure surges are near normal. Rod load is only 58% as high as when running one-half of the pump and only 16% greater than for the normal pump.

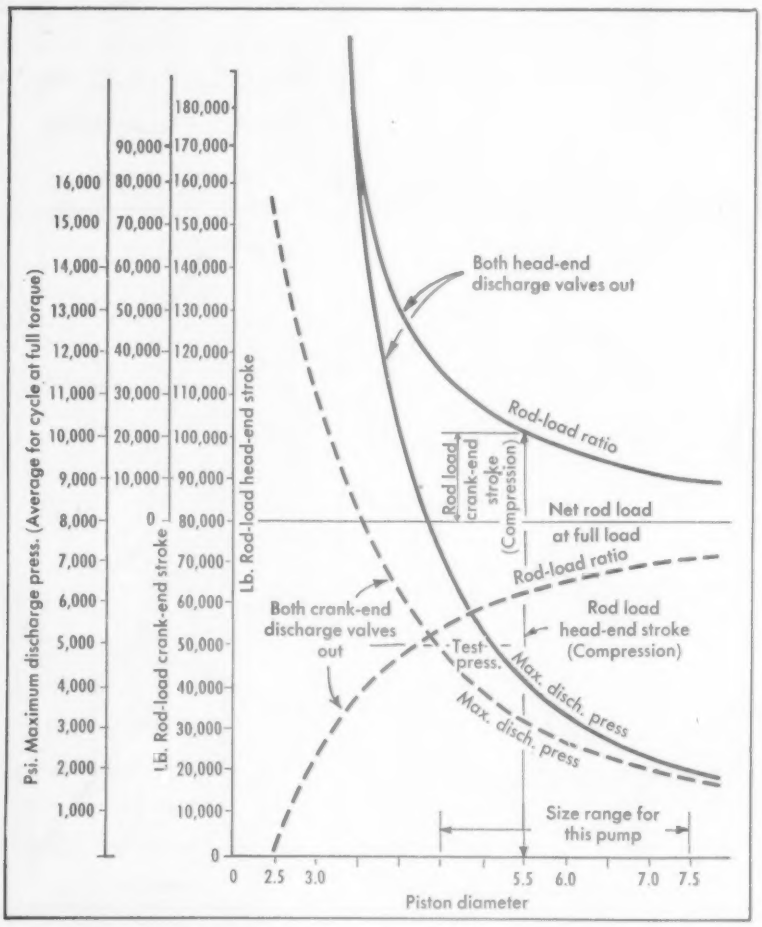
Running on one side. Fig. 12 shows what happens when the pump is run "on one side." In this case, the left-side suction valves are removed. Such an arrangement is simple, cuts the volume 50% and loads one bearing and rod normally. However, trouble can arise if the governor moves the engine to full torque. Maximum compressive rod load will be double the normal maximum load. Running will be rougher than in Figs. 3 or 9 (with equivalent piston diameters) because the rate of flow comes to a complete stop twice each cycle.

H-E-D valves out. It is interesting how big a difference a small change in the valve-removal pattern can make. For example, consider what happens when we remove both head-end discharge valves; in our previous example we removed both crank-end discharge valves.

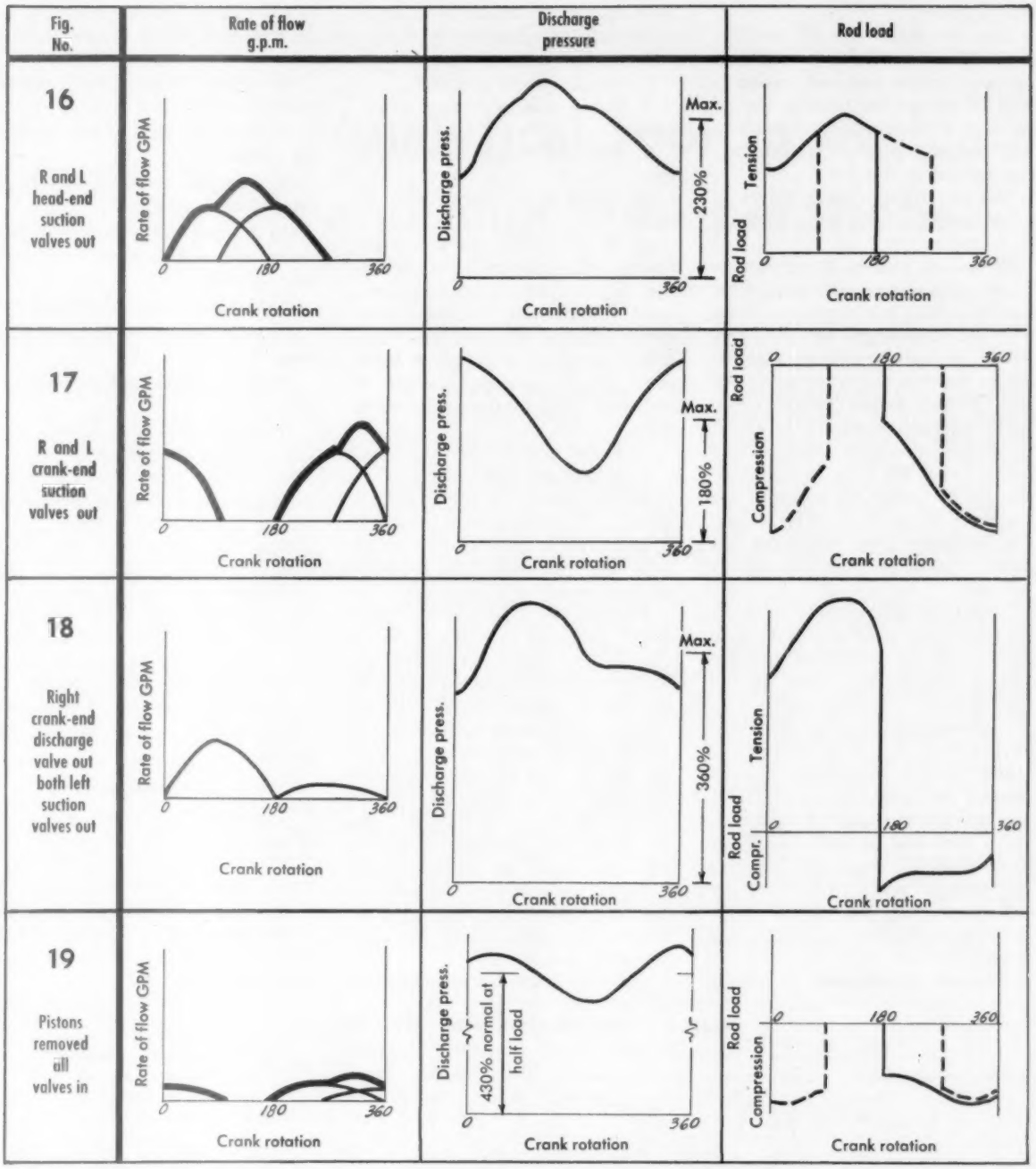
Fig. 13 shows the pattern of flow with the head-end discharge valves out. This pattern is complicated by the fact the crank-end stroke fails to deliver any fluid to the discharge line. The fluid moves through the pump manifold, down through the open head-end discharge-valve seat, and fills the cylinder as the piston moves back. In fact, additional fluid must flow from the discharge line to complete filling the space occupied by the moving rod. Fig. 14 shows this action.

When you add the effect of both right and left cylinders together, there is a backflow from the 80° position to the 190° position, as Fig. 13 indicates. Surging is a maximum. The rods are always under compression and greatly overloaded at 100% torque.

Fig. 15 plots the rod-load curve and pressure curves which occur at 100% torque. Compare these plots with those on Fig. 7. It is clear that rod loads are too great—being



ROD LOADS ARE TOO GREAT when both head-end discharge valves are out and pump is operated at 100% torque. Compare this to Fig. 7 where both crank-end discharge valves are removed. Fig. 15.



REMOVING SUCTION VALVES, as in top two arrangements, on both sides of pump, makes the pump single acting. Best pattern of removing three valves (for 25% flow) is in Fig. 18. Bottom curves shows plunger-pump action (with pistons removed). Figs. 16, 17, 18, and 19.

2.45 times normal with 4½-in. pistons.

Order of preference. At this point you can begin to see why, when we remove one valve, the order of preference is: crank-end discharge, crank-end suction, head-end suction, and head-end discharge.

Figs. 16 and 17 show the effects of removing both head-end suction valves or both crank-end suction valves. When a suction valve is removed, that side of the pump becomes single acting; the other end of the cylinder does all the pumping.

Removing the head-end suction valves leaves the crank-end discharge stroke effective. Result is higher fluid-end pressure at 100% torque. Hence, in Fig. 1 we rate this arrangement "poor." Also, the rod load is always in tension, a poor condition from the fatigue standpoint.

Flow can be reduced to 25% normal (for a given piston size) by removing three valves. First, we remove both left suction valves; this makes the pump single-sided. Then, we remove the right crank-end dis-

charge valve.

Fig. 18 shows rate of flow for such operation. Flow is delivered on both strokes and rod tension is high. If we use the smallest piston, result is a good rate-of-flow curve and discharge pressure is smoother; rod tension is also less.

We can remove three valves in other combinations, but the result is always poorer.

Removing pistons. If we remove both pistons from the pump, we simply convert it to a plunger pump with two suction and two discharge valves in each cylinder. Fig. 19 shows the rate - of - flow curve for this. At half engine torque, maximum discharge pressure is 430% of normal maximum. Such a load would break the fluid end or shear the safety valve. As a result, the engine must be blocked to prevent the governor from advancing the throttle to more than one-quarter torque.

There would be little pressure surging; little fluid is delivered in relation to the volume of the discharge system. Also, load on rod and bearings would be small.

Summing up. A lot of the information from Fig. 1 is presented in Table 3. Here, we compare the important variables, using as 100% the conditions when we have 5½-in. pistons and all valves in. From this tabulation, you can see that the volume per stroke is cut approximately 25, 50, or 75%, depending on whether we remove one valve, two, or three.

General observations. In general, we reduce the fluctuations or surges in rate of flow when we:

1. Reduce pump speed.
2. Reduce piston diameter.
3. Use a good pulsation dampener.
4. Maintain normal flow pattern by:

(a) Using large pistons with all valves in.

(b) Removing crank-end discharge valves and using small pistons.

The "maximum" discharge pressure in Fig. 5 is not really the "maximum" at all. It is simply a name given to the average pressure at full load. This maximum increases when:

1. Piston size decreases.
2. Valves are removed.

In fact, when the valves are removed, the maximum is inversely proportional to the remaining piston area. The maximum is the same for all pump speeds.

Manufacturers give their "maximum" pressures in terms of piston size. When valves are removed, the discharge pressure always exceeds the values approved by the manufacturer. For example, look at the maximum-discharge-pressure curve on Fig. 7; this is with crank-end discharge valves out. For piston sizes from 5¾-in. down to 4½-in., the maximum discharge is greater than the 2,950 psi. which is the highest "manufacturer's maximum discharge pressure." With 4½-in. pistons, pressure equals the test pressure of 5,000 psi.

All other plans for removing two valves produce higher pressure in the fluid end. Result is early fatigue failure.

We reduce the maximum rod and bearing load when we:

1. Distribute flow to four pumping strokes by:

(a) Pumping normally with largest pistons (see Fig. 7).

(b) Removing crank-end discharge valves and using small pistons (see Fig. 7).

2. Reduce surges in flow rate by:

(a) Using smoothest pumping pattern.

(b) Using a good pulsation dampener.

Drilling contractors should give serious thought to limiting the engine - throttle valve or fuel racks when running with some valves out.

Fig. 1 brings out another point. Consider the four pairs of valves which "will not pump." With any pair of these valves out, the suction and discharge manifolds are open to each other. The same situation may exist when you use any other plan of removing valves and the remaining valves are not in good condition with proper springs and guides.

Acknowledgment

This study is a result of the attention focused on the problem by Earle C. Hellums, Gracey-Hellums Corp., Houston, and by George H. Fyfe, Imperial Oil Ltd., Calgary. Jack Ammerman, Continental-Emsco Co., Houston, also made valuable comments.

TABLE 3—PUMP OPERATION WITH VALVES REMOVED

Refer to Fig.	Valve pattern: Right head Suct. 1	Right head Disch. 2	Cyl. crank Suct. 3	Cyl. crank Disch. 4	Left head Suct. 5	Left head Disch. 6	Cyl. crank Suct. 7	Cyl. crank Disch. 8	Piston area effective sq. in.*	Per cent normal: Vol. per stroke	Fluctuation rate of flow	Max. discharge pressure	Max. rod load
3	in	in	in	in	in	in	in	in	86	100	100	100	100
9	...	...	...	out	...	...	...	out	48	56	160	180	150
11	...	...	...	out	...	...	...	out	†32	37	64	270	120
12	...	...	...	out	...	...	...	out	‡88	102	315	100	235
13	...	out	...	...	...	out	...	...	38	44	280	220	265
..	...	...	...	out	...	...	...	...	67	78	190	130	130
..	...	out	...	...	...	...	...	...	62	72	260	140	140
17	...	...	out	...	...	...	out	...	48	56	220	180	220
..	...	...	out	...	...	...	...	...	67	78	230	130	130
16	out	...	...	...	out	...	...	...	38	44	190	230	190
12	...	...	...	...	out	...	out	...	43	50	160	200	215
18	...	...	...	out	out	...	out	...	24	28	140	360	300
..	out	...	...	...	...	...	...	out	43	50	190	200	170
19	Pistons removed from rods								10	12	56	Half load: 430	100

*5½-in. diameter piston; 2½-in. rod. †4½-in. diameter piston. ‡7½-in. diameter piston.

WANTED—By El Paso Natural Gas Co:

Analytical tool to evaluate and improve operations

. . . especially those having to do with equating supply with demand, since the system lacks adequate storage facilities.

BY HENRY B. MARTCH, JR.
El Paso Natural Gas Co.

DEVELOPMENT of an analytical tool to study present and find improved methods of operation is being sought by El Paso Natural Gas Co.

In February 1959, El Paso engaged General Electric to formulate and solve what El Paso calls the "transient flow equation." The immediate objective was to establish the time and space relationships, cause, and effects of unsteady natural-gas flow in pipelines.

El Paso owns and operates approximately 11,000 miles of high-pressure transmission line serving the western United States (Fig. 1). Peak-day delivery has exceeded 4,950 M.M.s.c.f.d. In brief, the operation is concerned with the purchasing and producing of natural gas for transmission and resale to the expanding western market.

Paper presented at the 1961 Pacific Coast Gas Association transmission conference.

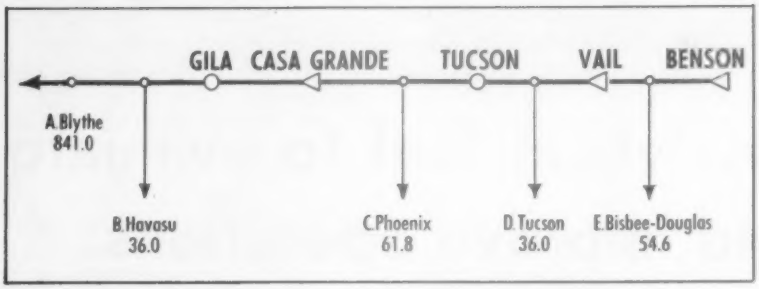
Storage lacking. Lacking adequate reservoir or storage facilities, this system must always be operated so as to equate supply with demand while performing its prime function—transmission. This problem of equating supply with demand is of vital importance to those people responsible for the scheduling of gas production to meet customer demands. Since customer demands fluctuate with the time of day, the transmission system is continually incurring changes in its pack level and in its capability to transport gas. The effects of those changes imposed upon the system influence the scheduling of gas production. It is therefore apparent that supply and demand are related through the variables time and space.

Recognizing that it is wise to walk before running, it was decided to concentrate efforts on only a portion of the system. A 300-mile stretch in southern Arizona was chosen for the test case (Fig. 2). This system terminates at Blythe, Calif., and is designed to deliver 805 M.M.s.c.f.d. at 500 psig. It is comprised of a 26-in.-o.d. pipeline looped with 26 and 30-in. o.d. There are five compressor stations; two are reciprocating stations and three are turbine-driven centrifugal stations. The terrain is erratic, from desert conditions at 300-ft. elevation through mountainous conditions at 4,300 ft.

Four equations. After the pipeline was completely documented to include all physical data, the basic mathematical relationships for transient flow in a pipe were written. Four equations are necessary to

EL PASO NATURAL GAS CO. operates 11,000 miles of high-pressure transmission lines extending from Texas to California and Washington. Fig. 1.

A 300-MILE PORTION in southern Arizona was selected for the test. It is a 26-in-o.d. looped line with both centrifugal and reciprocating stations and erratic terrain ranging from 300 to 4,300 ft. in elevation. Fig. 2.



HERE IS THE SYSTEM showing the deliveries at each discharge point in thousands of cubic feet per day. Fig. 3.

completely describe transient flow, one each for relating mass, change of momentum, change of energy, and the equation of state. The basic relationships are nonlinear partial differential equations, and their solution is not possible through application of known algebraic or rigorous analytical differential equation solution techniques.

It was evident that some "numerical technique" would have to be used to approximate the solutions. It was in this area that General Electric, assisted by El Paso, expended approximately 3 man-years of work. It is not the purpose here to present a detailed discussion of how we arrived here, but to simply state where we are.

The transient-flow equation, in conjunction with suitable mathematical representation of those compressor stations mentioned, forms a "mathematical model" of a portion of our system. The model has been programed for computer solution and in that form enables us to investigate the various effects resulting from **changes** in sales rates, discharge-pressure set points, and horsepower availability. Those resultant effects are exhibited in the form of computed pressures, flow rates, and pack levels along the length of the pipeline at any and every hour of the day, in addition to prime-mover horsepower requirements, surge conditions, centrifugal speeds, and compressor-plant fuel requirements. Additional intermediate results in the form of compressor efficiencies, cylinder loading, engine speeds, etc., are available for study but are not present in those results submitted to the dispatcher.

To explain the use of this model, here is a problem as it is presented to the computer and those results obtained from simulation.

The Problem

1. Given:

(a) The pipeline system as shown in Fig. 3 at 8 o'clock any morning.

(b) The anticipated sales patterns for points A, B, C, D, and E as shown in Figs. 4 through 8.

(c) The availability of: (1) twelve 1,000, one 1,100, and two 2,000-hp. reciprocating units at Gila; (2) three 5,700-hp. centrifugal units at Casa Grande; (3) seventeen 1,100-hp. reciprocating units at Tucson; (4) three 5,700-hp. centrifugal units at Vail; (5) two 5,700-hp. centrifugal units at Benson.

(d) The desired value of discharge pressures at each compressor station.

2. Required:

(a) The flow rate and pressure at each sales point.

(b) The flow rate and suction pressure at each compressor station.

(c) The number of units required at each reciprocating station, the number of centrifugal units required in addition to their respective speeds and horsepower requirements.

(d) Pack level for each line section.

(e) The flow-rate pattern for each line section.

(f) The amount of gas that must be curtailed in the event the system's capacity is exhausted.

(g) The values of discharge pressure which each station can support in the event that any station can no longer support that pressure which is desired.

In order that any solution may be evaluated for accuracy, a carefully instrumented and well-documented test must be performed on the real system which may be used as a basis in evaluating the mathematical model. On April 21 and 22, 1960, El Paso, in cooperation with the Southern California Companies, conducted a test. The flow rate at Blythe was curtailed approximately 100 M.M.s.c.f.d. for 10 hours and then increased to the original flow level for the rest of the test period. A plot of the resultant flow rate at Blythe is shown in Fig. 4. Similar flow rates were measured at each sales point along the system and were lumped conveniently into sales points B through E, Figs. 5 through 8. Simultaneously, pressures were measured with dead weights at the suction and discharge sides of each compressor station in addition to several other points of major interest.

Good agreement. Figs. 9 through 14 compare test pressures with pressures computed through use of the mathematical model. It should be noted that good agreement exists between test and computed values along the length of the system. There is some "phase shift" as we proceed back down the pipeline in a counterflow direction. It seems reasonable now to expect that this phase-shift problem will be solved.

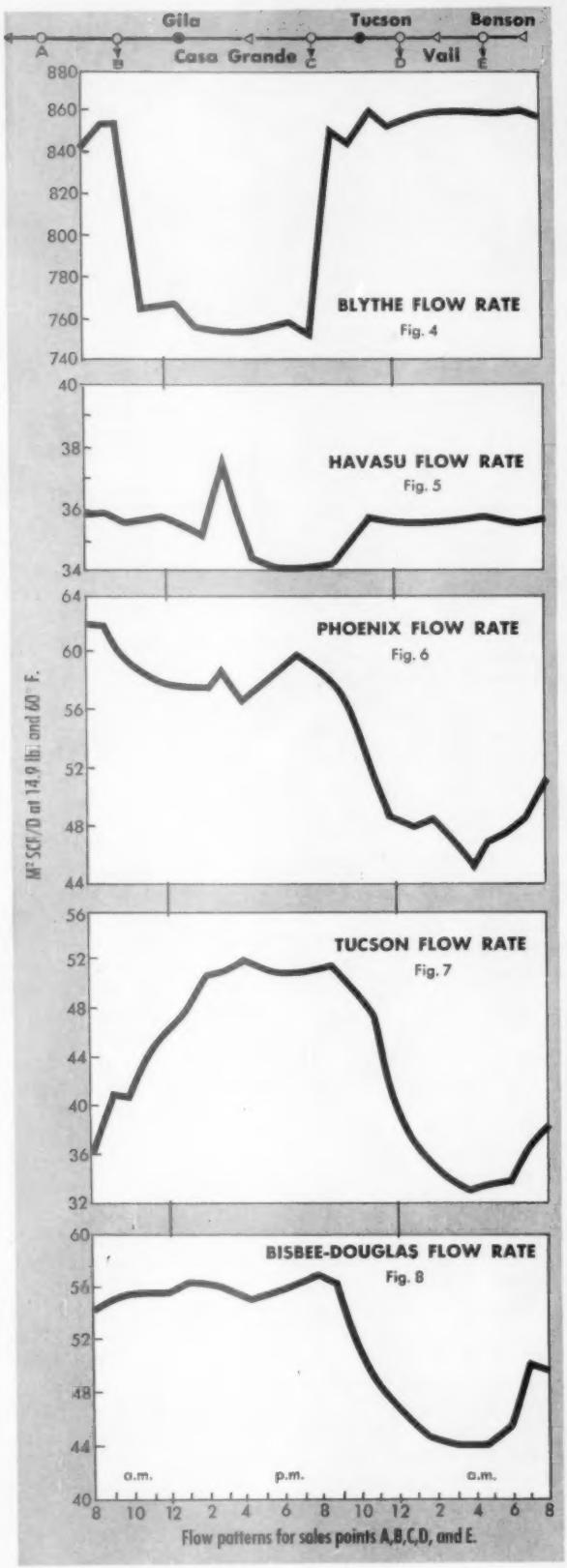
Pack levels and flow rates are not presented graphically herein; it is obvious that pressures result from flows, and pack levels are dependent upon pressures. Each of these values is of fundamental importance to the dispatcher and forms part of his report, along with answers to those problems and situations posed under "Requirements."

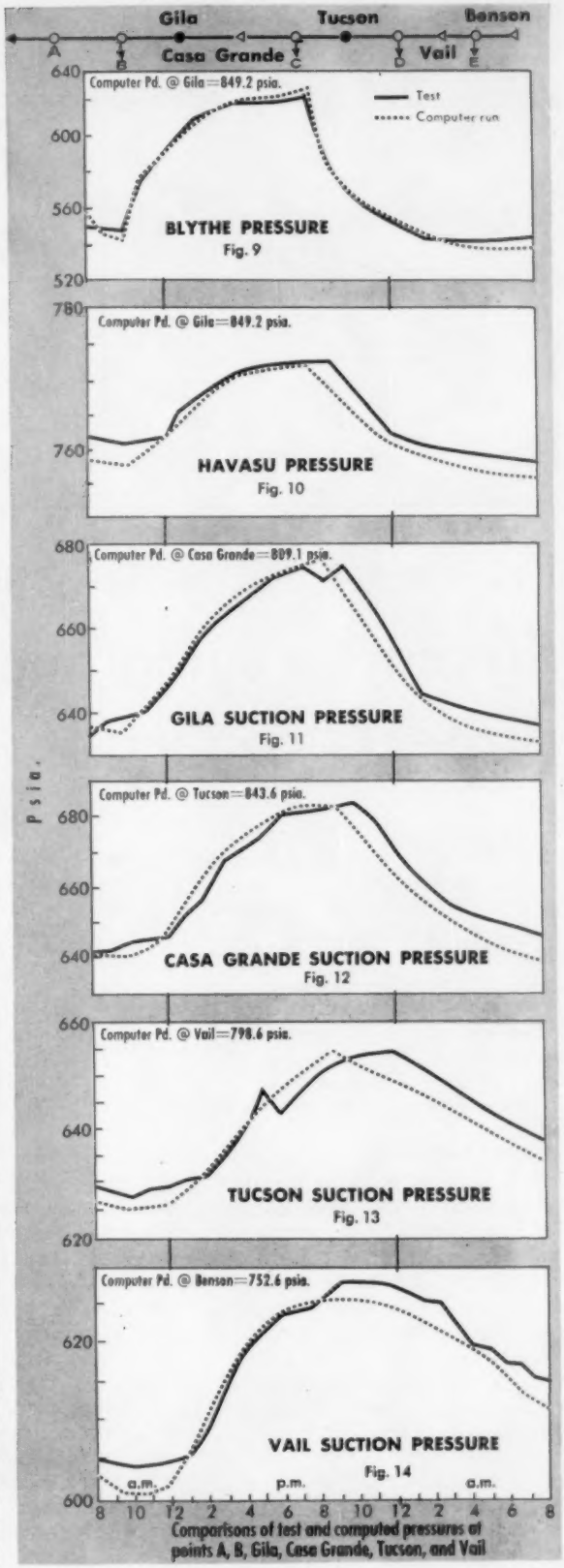
We have not completed our work in this area. Additional pipeline tests must and will be conducted to improve our understanding of the problem. We are actively engaged in minimizing the time required for computer solution, improving compressor representation, and formulating some over-all philosophy under which the system might be better operated. This work is proceeding with two goals in mind:

1. To improve transmission efficiency.

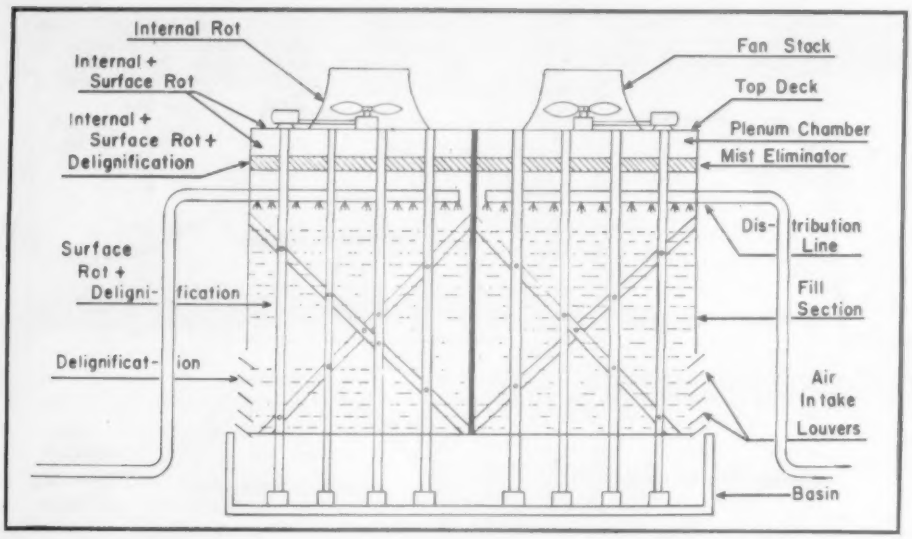
2. To provide some method with which we may better use existing pipeline facilities to equate supply with demand.

Armed with hope, some confidence, and a dash of understanding, we are furthering our efforts in the development of the transient-flow equation.





ANTICIPATED SALES PATTERNS by delivery points are shown in Figs. 4-8. Test pressures compared with those computed through the mathematical model are shown in Figs. 9-14.



STEAM - SPRAY method treats the plenum area of the tower which cannot be reached by adding chemicals to recirculating water. Fig. 1.

These "problem spots" are being licked as

Steam spraying microbiocides protects cooling-tower wood

A "STEAM-SPRAY" METHOD of treating cooling-tower lumber to control fungus attack is showing good results. The method consists essentially of using a steam-distribution system to spray nonwetted areas instead of doing it manually.

Basically, the system requires a steam source; a permanent, yet inexpensive, distribution piping system; and a feeding device.

Chief advantages of the system are:

... **Surface contact** with the chemical is maintained during the duration of the treatment. Manual spraying provides only momentary surface contact.

... **Chemicals** (chlorophenates) carried by steam seem to be able to penetrate the wood faster and deeper.

... **Chemical requirements** are about 50% less than when mechanical spraying is used.

... **Labor costs** over the long run are greatly reduced.

... **Since no one** must come in contact with the chemical, it is much safer.

Developed by Midland Gasoline Corp. in cooperation with Nalco Chemical Co., the system is being used successfully at Midland's Conroe, Tex., plant.

BY JOHN A. GERM, JR.
Water Stabilization Chemicals
Nalco Chemical Co.

AND J. M. HINDMAN
Superintendent, Midland Gasoline Corp., Conroe, Tex.

Types of Attack

There are two definite types of deterioration. One is chemical in nature and the other is caused by the action of microorganisms. By adhering to industry recommendations for water conditioning, chemical attack can be minimized or arrested.

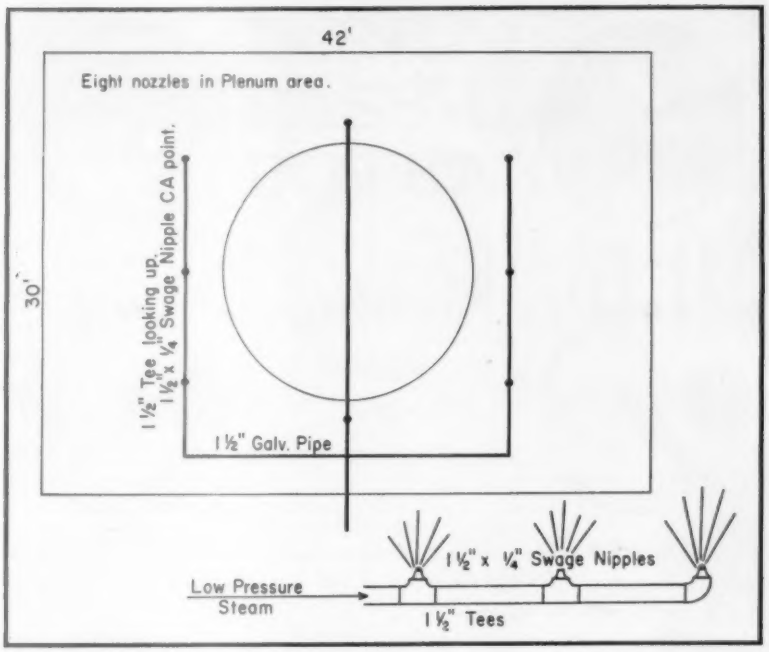
On the other hand, microbiological attack can take the form of surface attack and internal attack. Fig. 1 outlines the locations where both types usually are found. Generally, natural preservatives found in cooling-tower lumber are leached from the wood by tower operation. This leaching process is speeded by chlorination, high alkalinities, and high pH. The combination of two or more of these factors accelerates the leaching process.

As the natural preservatives are extracted, the wood then becomes more susceptible to microbiological attack. This type of attack is generally attributed to fungi although certain cellulolytic bacteria have the ability to produce attack also.

Depending upon the type, fungi may destroy the cellulose, leaving the lignin, or destroy both cellulose and lignin simultaneously. In either case, the net result is the systematic and often rapid destruction of the lumber.

In the water-washed areas of the cooling tower (those areas below the cooling-water distribution system), microbiocidal treatments to control fungal attack can be easily applied. Chlorophenates are excellent specific microbiocides against most fungi. The addition of chlorophenate compounds to recirculating waters generally controls fungal infection and extends tower-life expectancy in those areas which are contacted by the recirculating waters, and where the infection is generally smaller.

Fungi do not grow in the absence


42'
Eight nozzles in Plenum area.
30'
1 ½" Tee looking up
1 ½" x ¼" Swage Nipple CA point.
1 ½" Galv. Pipe
1 ½" x ¼" Swage Nipples
Low Pressure Steam
1 ½" Tees

PERMANENT STEAM-DISTRIBUTION system placed in the plenum area insures effective, safe treatment. Fig. 2.

of free oxygen; therefore, they offer fewer problems in those areas of the tower which are continually wet or submerged.

It is in the plenum area of the tower, including structural and supporting members, mist eliminators, and partition and casing wells where attack by internal-decay-producing fungi is most prevalent and damaging.

Chlorophenates continue to retain their excellent activity against decay-producing fungi when used in the plenum areas of the tower. The problem that now exists is: "How do we treat these areas properly?" The number of ways and means of treating the plenum areas are limited only by the ingenuity of the operators and their suppliers.

The classic approach has been to prepare a 10-30% solution of a chlorophenate formulation. This solution is then applied to the plenum areas by various mechanical means, such as a hand-operated garden sprayer. A more elaborate form of this method would use a compressor unit, such as may be used by spray-painting contractors.

These methods require the operator to crawl about the structure. As you can see, this operator must be protected against contact with the chemical solution and its vapors. Generally, a rubber or plastic rain suit is used with a suitable hood to cover the head and face. In addition, a breathing apparatus is generally required for complete safety especially in enclosed areas.

Another approach has been used in towers that are equipped with reversible and variable speed fans. In this method, you reverse the fans at slow speed, fog the microbiocidal solution into the fan ring with a fog nozzle, and rely on the downdraft to distribute the treatment. In this manner, however, the downwind side of the wooden members does not receive adequate coverage, unless the procedure is reversed and the chemical is fogged in from the base of the tower.

The steam-spray method overcomes these disadvantages.

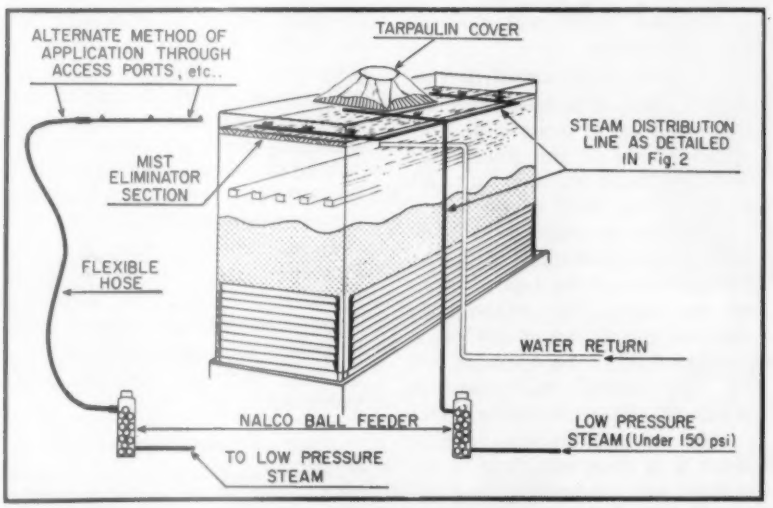
Here's how it works:

The steam source at Midland's plant was a 140-psig. steam line in the vicinity of the cooling tower. In the absence of an adjacent steam source, a portable steam-generation unit would serve the purpose.

The permanent distribution system consisted of a 1½-in. galvanized-steel riser which was attached to the outside wall of the cooling tower. A 90° elbow brought the main distribution line through the tower wall at a point immediately above the mist eliminators.

Inside the plenum chamber, which in this case was 30 by 42 by 5 ft. 7 in. deep, the main distribution line was branched into a grid resembling the block letter E.

As shown in Fig. 2, a group of eight nozzles was used. These nozzles were fabricated by merely installing 1½-in. tees in the distribution grid in which 1½ by ¼-in. swage nipples were installed facing upward. With 40 psi. of steam-injection pressure, there was complete coverage of the plenum area.


ALTERNATE METHOD OF APPLICATION THROUGH ACCESS PORTS, etc..
TARPAULIN COVER
STEAM DISTRIBUTION LINE AS DETAILED IN Fig. 2
MIST ELIMINATOR SECTION
FLEXIBLE HOSE
WATER RETURN
NALCO BALL FEEDER
LOW PRESSURE STEAM (Under 150 psi)
TO LOW PRESSURE STEAM

CELL TREATMENT requires about 4 to 6 hours and about 10 lb. of chemical (blended chlorophenates) per hour. Fig. 3.

This distribution system must be duplicated in each cell where treatment is desired. It is excellent for those towers designed for horizontal mist-eliminator sections. For those with canted mist-eliminator sections, the grid must be modified.

Feeding device. Heart of the "steam spray" system is a simple feeding device that can be fabricated in most shops using a piece of 12-in. steel piping long enough to provide the desired capacity.

A 4-in. (minimum) valve installed at the top of the feeder (see Fig. 3) provides an easy method of charging the feeder with the chemical. In this case it is in the form of a ball briquette approximately 3 in. in diameter and weighs about 1 lb.

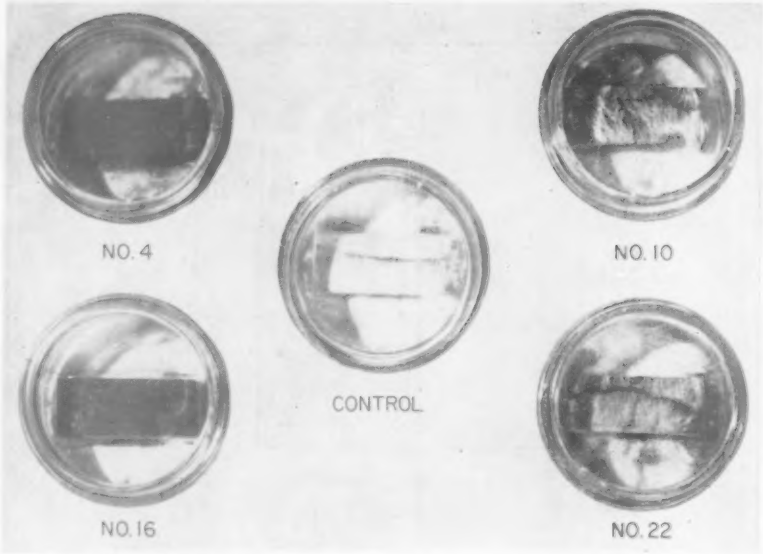
A feeder capable of containing about 40 lb. of chemical should be sufficient to treat one cell over a 4-hour period. The bypass type feeder, which is commercially available in a number of sizes, can be adapted for use in this application.

At Midland's plant, the feeder was connected to the system with flexible tubing or hose, and the entire unit placed on a platform scale. By adjusting the calibrated control valve on the side of the feeder, a more or less constant feed rate of 10 lb. of chemical per hour can be attained. Eventually, the scale will not be necessary as the operators gain experience, and can set the valves to feed at the desired rate.

Although the Midland operations were designed to use the ball briquette form of blended chlorophenates, similar products are available in liquid form. Using liquid chlorophenates, the feeding device may consist of a pressure vessel using a plant air source to force the chemical into the steam riser line.

In fact, a simple steam-operated aspirator with the proper control valves would be acceptable. In this manner, the chemical could be fed from its original container, thus eliminating need for handling and transferring.

Treating method. When the tower is rigged for operation, the feeding device charged, and a steam supply available, it is necessary to shut the cooling-tower-cell fan down.



TEST BLOCKS left in the tower for 4 weeks after treatment show the effectiveness of steam-spray method. Fig. 4.

For best results, the recirculating water should also be stopped, although in critical heat-load situations water recirculation may be continued during the treatment period.

Under most conditions, it will be best to provide a canvas or plastic cover for the fan stack on the cell under treatment. This prevents the treatment-laden steam from being discharged into the atmosphere where its benefits are wasted.

Aside from an occasional check by the operator, or for recharging chemical, the "steam spray" operation requires little attention during the treatment which will normally last 4 to 6 hours.

During the treatment, if the water circulation is stopped, you will note that wisps of steam issue from various points in the tower, and eventually from the air intake louvers at the base of the tower. If the water is allowed to recirculate, a slight downdraft is created, drawing some of the treated steam into the water. This prolongs the treatment period but is not otherwise harmful, as the chemical will also help control microbiological growths in the recirculating water.

If the cell to be treated is heavily loaded with slime and algae, it will be killed and substantially dispersed during or shortly after the treatment.

In the test tower, the "steam spray" operation was completed in 4 hours and used about 40 lb. of chemical per cell.

Redwood test blocks installed in the test cell during the treatment were evaluated analytically. They contained approximately 1 mg. of treatment per square inch of surface area after being leached, by operating the tower, for 1 week after the treatment.

Surface-resistance (to known wood-rot organisms) tests on the redwood blocks which were installed in the tower during the treatment show the blocks to offer "good to excellent" resistance to the test fungi. Fig. 4 shows the degree of resistance after 4 weeks in the system. Blocks 4 and 16 were located in the mist-eliminator section (area treated by steam application). Blocks 10 and 22 were in fill section (untreated). The control block was an untreated test block from the lab.

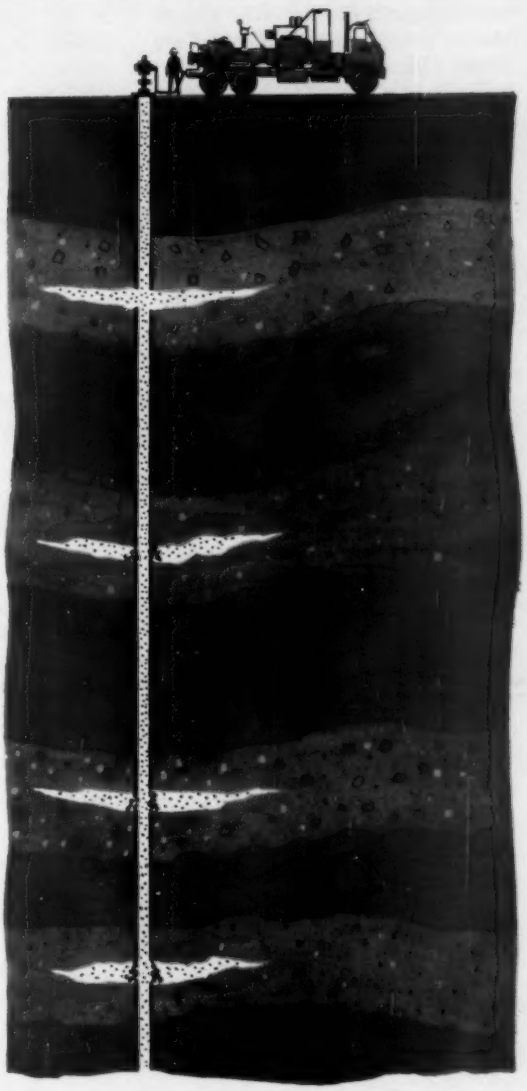
Even after 3 months of tower operation, which has the effect of leaching the treatment from the wood, resistance was good. Current plans are to retreat each cell on a 3-month cycle to offer continuing protection.

Acknowledgment

The efforts and cooperation of the microbiological laboratories at Nalco Chemical Co. are gratefully acknowledged. We especially wish to thank Peter Song for his efforts and contributions.

DON'T PASS UP POTENTIAL PAYZONES

...first consider MULTIFRAC



Are you passing up profitable payzones, particularly those separated by impermeable layers? You may be if you haven't used Halliburton's Multifrac treatment. Several zones can be fractured in a *single continuous operation* by creating the first fracture . . . then temporarily plugging it to divert the fracturing punch to the next weakest interval and repeating until several potential payzones have opened.

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Perfpac – economical, specially-constructed balls are simply injected into the fracturing fluid stream to temporarily seal perforations in casing.

Temgel – a hydrocarbon base mixture which is pumped in the fluid state, quickly gels into a very firm mass that acts as a diverting agent, then breaks back to a thinned fluid in time.

Gel Plug – another fluid type temporary blocking agent that helps isolate particular intervals for greater control during multiple fracturing.

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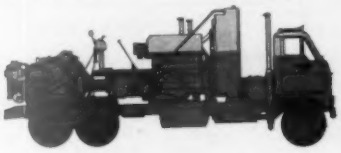

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Here's a system that has as its goal:

Precise control of alky-unit deisobutanizers

. . . and 2½ years of operation prove it's strictly on target

BY WILLAS L. VERMILION
Standard Oil Co. (Ohio), Cleveland

A CONTROL SYSTEM based on temperature differentials in the bottom section of a debutanizer tower has been developed to maximize fractionation efficiency. The system aims at precise control of isobutane losses with optimum overhead purity.

The major reason why this control system is operable is the basic understanding of the system by all concerned and defining temperature differentials in advance of the first attempts to operate the tower.

Deisobutanizer Function

Alkylate quality and acid consumption for a sulfuric acid alkylation unit vary directly as a function of the isobutane concentration at the point of reaction. Isobutane concentration varies with ability of the deisobutanizer to deliver quantity and purity in the isobutane recycle.

For maximum overhead quality and recycle quantity, with minimum isobutane losses, the per cent isobutane in the bottoms is extremely critical. This quantity is expressed as per cent isobutane in the spent butane, the overhead product from the following tower.

Presented at WPRA Gulf Coast regional meeting, 1961, Houston.

The effect of per cent isobutane in the spent butane on overhead quality is shown in Fig. 1. This operation attempted to hold 10% isobutane in the spent butane. The tower was operating at maximum load. The overhead product suffered severely during periods that there was no isobutane in the bottom.

Fractionation improved as 5% to 10% isobutane showed up in the spent butane but little more as the per cent isobutane continued to climb. Quality improvement continued slightly as per cent isobutane rose to 20 to 30% in the spent butane, but the loss of isobutane outweighed gains made in fractionation.

New Control

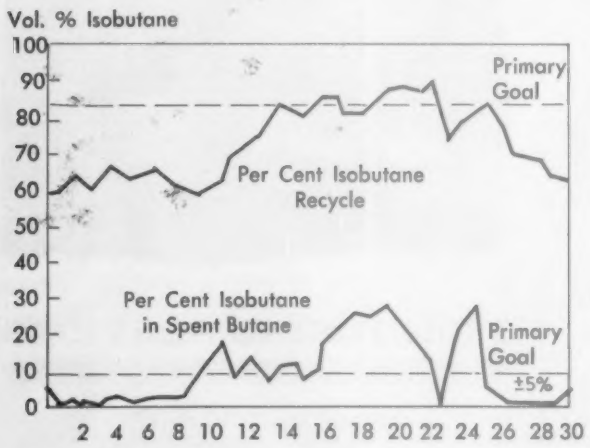
Composition profile of a 50-tray deisobutanizer was calculated. The C_5 and C_6 plus fractions in the liquid on the trays are essentially constant between the feed trays (No. 11 from the top) and tray 40 in the bottom, Fig. 2. The only composition variation is the switch from isobutane to normal butane.

A feed-forward control system can be developed on the basis of temperature difference between trays above the reboiler and below the feed plate, if the degree of fractionation between any given trays in this tower section can be correlated with the fractionation to be done in the remaining trays.

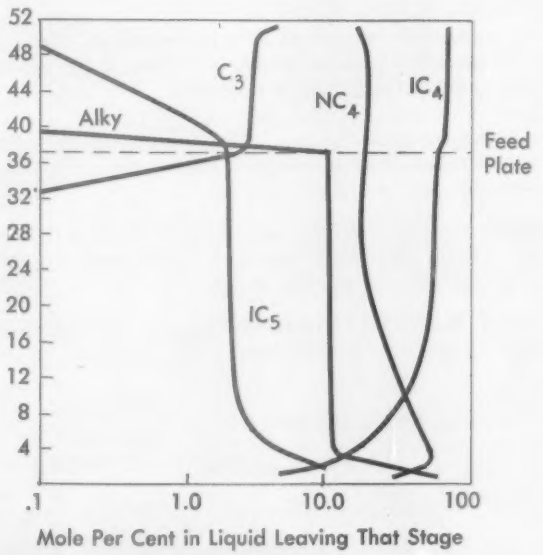
The actual temperature is of no importance because its level is determined by the amount of alkylate and pentanes in the tower. However, the temperature difference is an indication of the degree of fractionation. A system on this basis was designed for our deisobutanizer in the alkylation unit.

Control system, Fig. 3, incorporates a 1,000-bbl. isobutane storage drum to even out feed variations without upsetting unit balance. Recycle to the reactor is on flow control. The level in the surge drum raises as excess isobutane is fed to the plant and falls when feed is deficient.

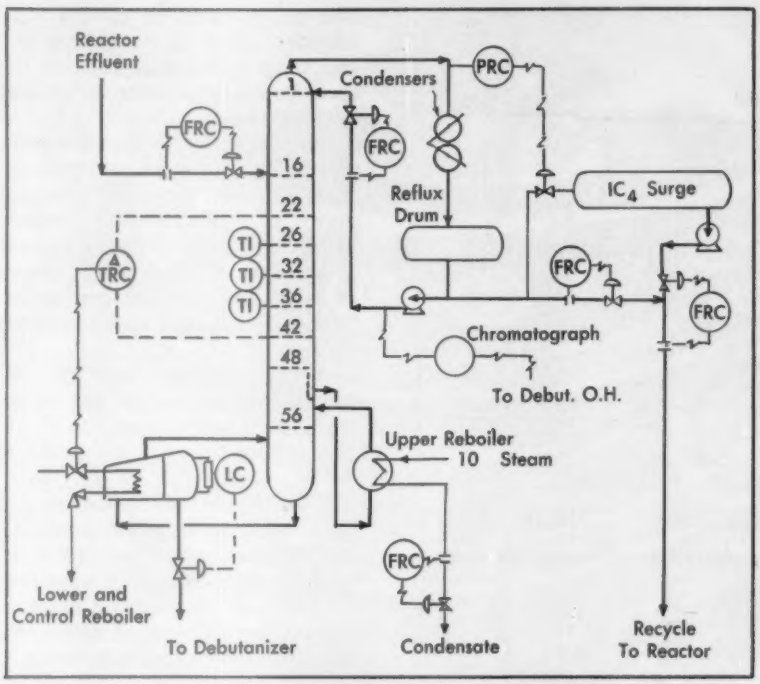
Feed, reflux, and steam conden-



ORIGINAL TOWER CONTROL shows the per cent isobutane in recycle vs. per cent isobutane in spent butane at constant power loading. Fig. 1.



DEISOBUTANIZER TOWER composition plate-by-plate-by-machine-calculation method. Fig. 2.



NEW CONTROL SYSTEM for the deisobutanizer tower in the alkylation unit. Fig. 3.

sate from the upper reboiler are on flow control. The upper reboiler uses 10-psi. refrigeration-turbine exhaust steam and carries 80% of the total reboiler load. The temperature differential between trays 22 and 42 controls 150-psi. steam to the lower reboiler. Bottoms product is removed on level control.

Valve specification for the reboiler steam valve raised the question of whether increased differential should open or close the valve. It was obvious there would be no differential temperature if there was 100% of either isobutane or normal butane in the butane on the trays.

It was assumed initially that increasing differential should reduce steam to the reboiler, but there was enough doubt to warrant investigation. Accordingly, a series of computer calculations, using the Bonner program, was run to determine the theoretical temperature differential curves at several alkylate throughputs and varying isobutane in the bottoms.

The results are shown in part of Figs. 4 and 5. The curves are plotted against isobutane in the spent butane, assuming complete debutanization of the alkylate.

Surprisingly enough, the peak for each of the differential curves investigated is in the 2 to 4% isobutane range in spent butane, or just about where the average refiner would like to operate. The temperature differential for the alkylation unit was to be installed initially between the 22-42 tray.

It was decided to operate on the high per cent side of the differential curve, and the instrument was set up to decrease steam to the reboiler as the temperature differential increased.

Startup originally was May 1958. First, the overhead system was "lined out" to a constant pressure operation. Then, the differential control cautiously was put on stream by gradually lowering the steam to the lower reboiler until the differential peaked.

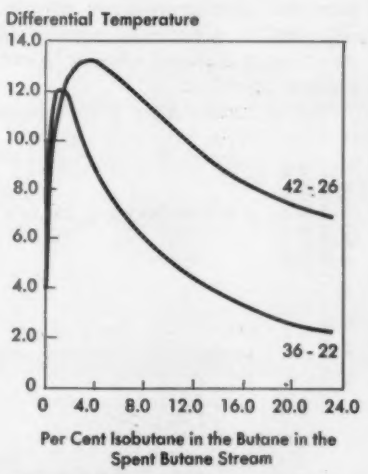
The differential recording during the operation peaked at exactly 15.2° F., Fig. 6a. Once over the peak the controller was "locked in" at 13.5° F. The tower and its control system were on stream successfully.

Mechanical problems brought the unit down several days later and when started up the same procedure was followed. However, a heavy hand on the intermediate reboiler control flooded the tower and the system went through the peak area with the temperature differential showing it.

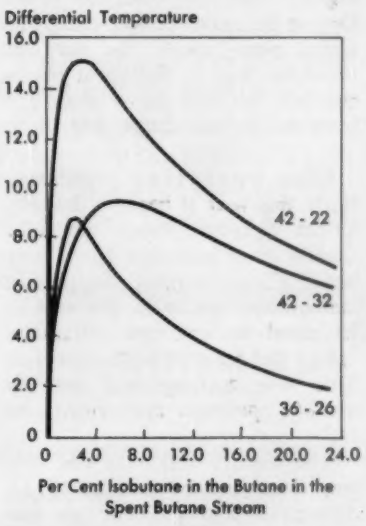
Weathering tests of the spent butane plus a look at the other differentials showed that the tower was letting 35 to 40% isobutane out in the spent butane. Steam was increased then to the lower reboiler till 13.5° F. differential was observed. At this point the instrument was put on automatic and the tower was in complete control again, Fig. 6b.

The realization that the other temperature differentials could tell on which side of the peak control was seemed to solve the biggest operator question.

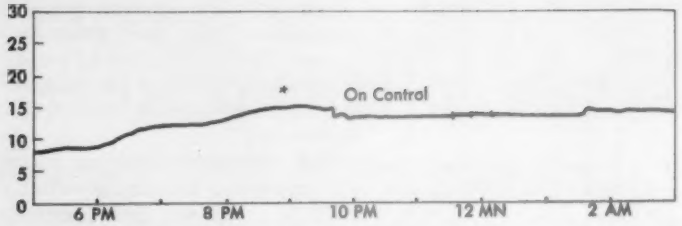
Control during this initial period was excellent. At 13.5° to 14° F.



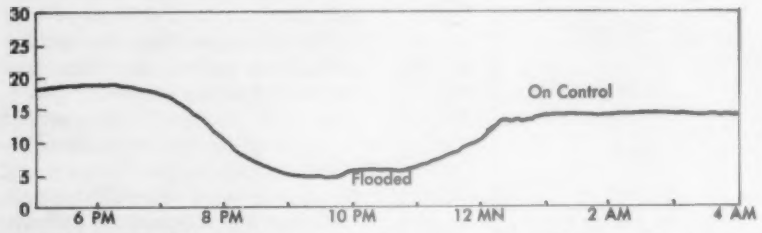
TEMPERATURE DIFFERENTIALS between trays 22-36, and 26-42. Fig. 4.



TEMPERATURE DIFFERENTIALS between trays 26-36, 32-42, and 22-42. Initial control was made between trays 22-42. Fig. 5.



TEMPERATURE-DIFFERENTIAL record from initial startup. Peak differential (*) is at 15.2° F. Fig. 6a.



TEMPERATURE-DIFFERENTIAL record showing recovery from flooded operation. Fig. 6b.

differential the operators were able to maintain 5% ± 1% in the spent butane regardless of alkylation rate. Some of the ±1% variation was due to vapor-pressure changes of the total alkylate.

Shortly after June 1958, crude butane containing 15 to 20% isobutane was fed to the tower between the differential points. Controller operation was not upset but the peak height seemed to change. Accordingly, a new peak height was determined at 18° F. and the controller was set to run at 17° F.

Several times during the past 2½ years the peak high was shifted slightly and the controller reset. During the entire period, except for major plant upsets, the per cent isobutane loss in the spent butane has not deviated more than 1% from the desired target, Fig. 7.

Other operating experiences. Early this year it became desirable to cut isobutane losses and suffer slightly lower isobutane purity overhead. The instrument was put on manual and steam to the reboiler increased to put the differential "over the peak" on the low side. This was accomplished and the manual operation maintained control.

The control action of the valve was then reversed and at 17° F. differential setting on the low side. Isobutane in the spent butane has averaged 2% for several months while chromatograph readings varied from 1.5 to 2.5% during this period.

One of the more interesting operations observed during the past 2 years is a period when the plant went isoshort. When this happened, the overhead product flow dropped off, the pressure valve closed, and tower pressure gradually drifted down to about 65 psig. before the situation was rectified. The temperature differential controller maintained the desired isobutane in the spent butane all the way down and then back up again to operating pressure as isobutane became available.

The system cannot "ride out" all upsets, however. In the case of a major unit upset the differential has "bounced" over the peak, at which time the valve operated in reverse. This led to a runaway reboiler in one case or a closed reboiler in our present operation.

The operators have always been able to get back in control with minimum effort by recognizing this and using a chromatograph of the spent butane plus other differential curves.

There is some doubt at this point that Sohio's operation is optimum. It is possible that our overhead purity vs. isobutane losses should be about 2.5 to 3.0% isobutane in the spent butane which cannot be controlled from our present differential points since the curve peaks there.

Adequate control at 3.0% isobutane in spent butane can be accomplished by shifting to the 22-36-tray differential which peaks at 1.5%.

Control systems similar to this have been investigated previously for deisobutanizers and have resulted in an uncontrolled operation. In fact, one paper stated emphatically that temperature differential for an alkylation unit deisobutanizer was impossible.[1]

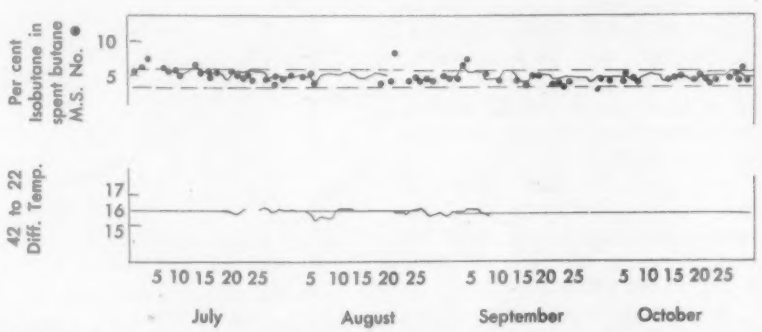
Conclusions

It is inconceivable that differential curves could have been derived from operating data. In addition, it is highly probable that the curves never would have been derived if machine calculations had not been available to do the 25 tray-to-tray calculations necessary to establish the temperature profiles.

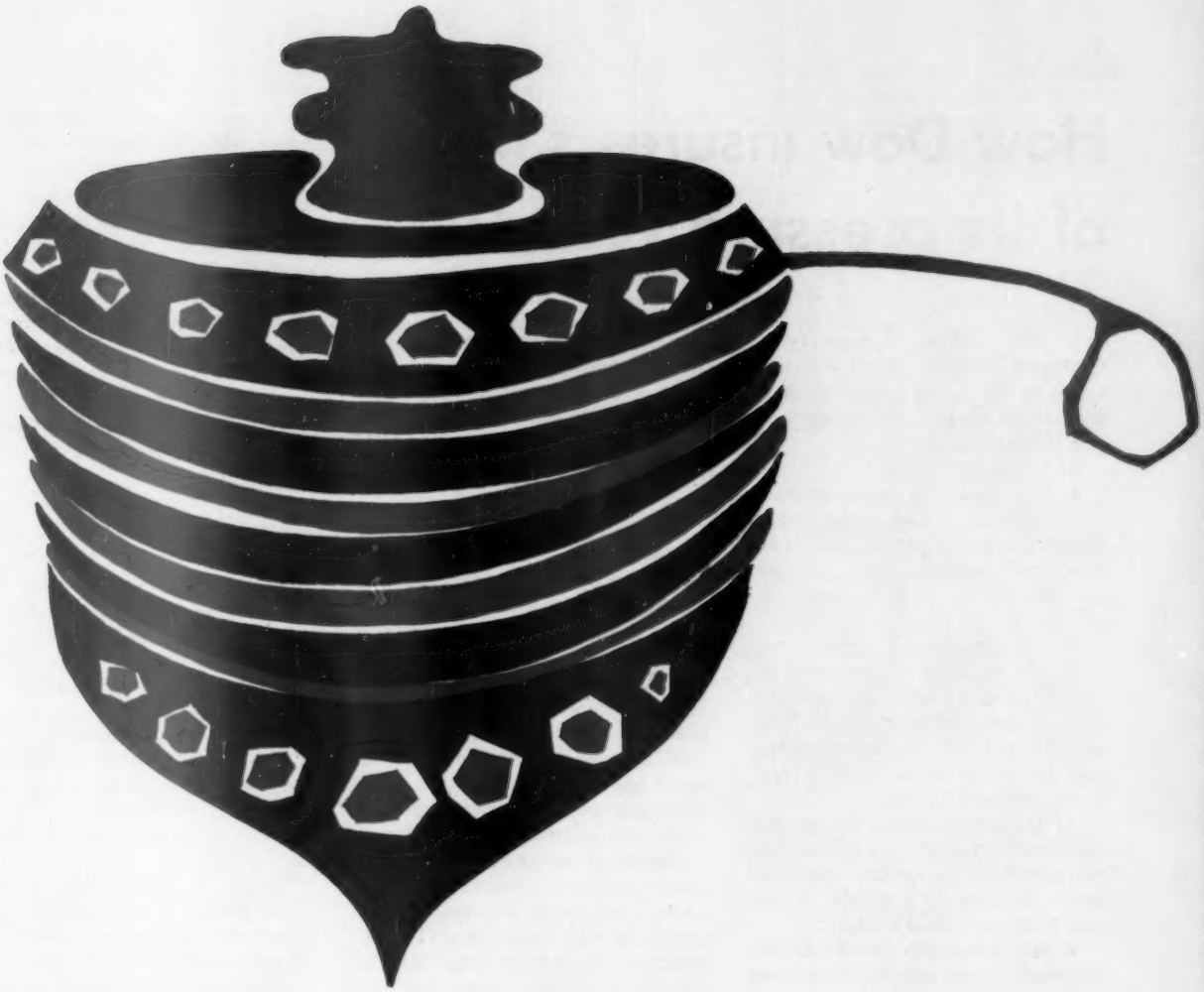
The combination of having the answer before the problem presented itself, plus the operators' awareness of the pitfalls of such a system, has made a potentially impossible control system into a trouble-free operation.

Reference

1. Webber, W. O., "Control by Temperature Difference?" Petroleum Refiner, 38, No. 5, May 1959, p. 187.



A PLOT of several months' daily data on the system shows the degree of control obtained. Fig. 7.



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How Dow insures safety of its pressure vessels

BY C. E. LAUTZENHEISER
AND F. B. CROUCH, JR.
Dow Chemical Co.

A CLOSE LOOK at pressure-vessel-testing practice shows the emphasis to be on these three primary methods of securing information:

- Operating history.
- Visual inspection.
- Wall-thickness measurements.

In addition, strain gage, brittle lacquer, magnetic particle, dye penetrant, radiographic, eddy current, and other tests are used where applicable.

Dow Chemical Co. implements emphasis on safety in operations by use of pressure vessels designed and fabricated according to ASME Pressure Vessel Code. Piping safety factors are equal to, or greater than, those specified by ASA.

All field-construction welding and subsequent maintenance welding are performed by procedures qualified under Section IX, ASME Boiler and Pressure Vessel Code.

A design engineer reviews all test information and data before placing them in the vessel folder.

Wall thickness and other test results are used to check whether the vessel still meets safety requirements. During the check, corrosion rate is calculated and date of next inspection is found.

An automatic schedule of vessels due for testing is planned by placing vessel-inspection history on IBM cards.

Paper presented at the ASME summer-annual meeting, Los Angeles, June 1961.

Primary Sources

It is certain that every test engineer will place a different value on test information. We believe that the following is some of the most important information obtained from the three primary sources:

1. Operating history is an important and sometimes overlooked source of information. Vessel owner and operating personnel know of small operating changes that affect the vessel which the inspector could never find in the short test period.

Operating personnel know of any excess pressures, temperatures, hot spots, leaks, or minor repairs made since the last inspection. The inspection group must have this information so they may make the proper test of inspection at points where damage is known or expected to exist.

2. Visual inspection is essential and should be made especially for inspection purposes, not as an afterthought of some other operation. Inspection results and types of inspection called for are noted on a special folder.

Inspector must note condition of vessel components as listed and any other applicable equipment. Other tests such as radiographic, magnetic particle, dye penetrant, etc., frequently will be required because of defects found or suspected at the time of visual test.

Vessel grounding to insure good connections and continuity is especially important on vessels containing flammable materials.

Examine skirts and vessel supports for evidence of corrosion, cracks, or other defects. Interior surfaces of skirts particularly need a careful examination.

Check anchor bolts for signs of corrosion. Insure that the bolt is not corroded under the nut or in the foundation by removing the nut and examining visually or by tapping with a hammer.

Discharge piping from pressure-relief devices to atmosphere must be free from plugging and corrosion. If this piping is corroded, as frequently is the case, any sudden discharge from the relief device could shatter the pipe and discharge vapor into the atmosphere around the vessel. Also check for external corrosion of rupture disk and for disk leaks.

3. Metal-thickness determinations

Mobile test vehicle is instrument equipped

Dow equipped a mobile test vehicle with shock-mounted resonance and pulse-echo ultrasonic instruments. The equipment operator selects the proper instrument to obtain the desired measurement accuracy.

Also, the instruments can cross-check measurement accuracy. Since both instruments operate on different principles, measurement reliability is assured when both give the same value within their accuracy limits.

C. E. Lautzenheiser (left), one of the authors, is shown checking the equipment with Walter Henson, a technician in the testing crew.

of the vessel's retaining walls are an item of major interest to the owner and operator. Contents or reaction products in some cases can cause serious impairment to physical properties of the metal walls. Hydrogen embrittlement is an example.

However, the vessel owner's greatest concern will be to insure that sufficient thickness of sound metal remains to contain operating pressure at corresponding operating temperatures.

Metal-thickness measurements can be made by any convenient method that yields accurate values. Almost all our metal-thickness measurements are made by ultrasonic techniques.[1]

However, sometimes it is necessary to drill holes through the vessel wall. Wall thickness at the hole then can be measured with an inspector's gage or hook gage. After inspection, the hole is sealed by either a plug and welding or a threaded plug for easy future accessibility.

Two types of instruments, using ultrasonic sound-wave generators, are used for finding thickness.

The two types of ultrasonic testing equipment are resonance and pulse-echo.

Measurements usually are made with the vessel on stream. Only one side of the vessel must be available to the inspector when using these instruments. Resonance-type instruments we use are the Vidigage and Audigage. Audigage is portable and operated by one man. Readings can be made with an average accuracy of plus or minus 3% at the rate of 15 to 20 readings per hour.

Vidigage requires two people for normal operation but is much more accurate and rapid. Routine accuracy is well within ± 1% and under good conditions several hundred readings per hour may be made. Both instruments are relatively sensitive to surface roughness, deposits on the back side, thick paint, and other nonideal conditions.

Pulse-echo-type equipment, such as Sonoray and Reflectoscope, cannot be read with quite the accuracy or speed of the Vidigage. However, these instruments will give readings under conditions impossible for resonance instruments with an accuracy of ± 0.010 in.

Another advantage of pulse-echo equipment is that the same limit of accuracy, ± 0.010 in. applies regardless of material thickness which is quite important on heavy-walled vessels.

Special consideration must be given vessels which are constructed of integrally clad plate or fabricated with a protective metal lining. Total base-plate and lining thickness measurements are made by drilling a hole and calipering.

When using ultrasonic techniques, if the vessel has an applied liner, as differentiated from a metallurgically bonded clad liner, the base plate may be measured from the outside; the lining may be measured from the inside.

However, with a metallurgically clad liner, both base plate and lining will show in a measurement made from either side. The only way to be certain any corrosion is external or internal is to remove a section by trepanning.

Heat-exchanger tubing is a point often overlooked in pressure vessel testing. Although tubing failure is not necessarily a safety item, it is important that tubing be in condition to last until the next check period.

Tubing should not only be pressure tested but also should be checked for corrosion and pitting. We have used a Shell Probalog to check nonferrous heat-exchanger tubing.

We presently are evaluating a new and much more sensitive eddy-current device. The new device holds promise of being able to check ferrous tubing.

Boroscopes are used to find tube pitting but are quite slow and laborious.

Hydrostatic Test

Review of pressure-vessel tests minimizes the use of standard hydrostatic test. We believe that a hydrostatic test to 1½ times the maximum allowable pressure yields little information about wall corrosion. An illustration of this is a test made on a vessel procured from salvage.

The vessel was 6-ft. diameter by 20 ft. long. Original shell thickness was ⅜ in. and dished heads were ½ in. thick. Maximum allowable working pressure was 67 psi. based on 13,750-psi. hoop stress in a ¼-in. wall. Corrosion allowance was ⅛ in. Joint efficiency was 70%.

Visual examination of the vessel interior showed large areas of severe corrosion. Wall thickness in these areas was about ⅛ in. with measured pits down to a remaining wall of 1/16 in.

A hydrostatic test was made to 104 psi. which was slightly over 1½ times the 67-psi. maximum allowable working pressure. There was no evidence of failure in any portion of the vessel.

Calculated hoop stress at 104 psi. in the ⅛-in. areas was about 30,000 psi. and stress in the bottom of the 1/16-in. pits must have been much over the material's yield strength.

A hydrostatic test can be made in conjunction with other techniques although it alone is not of much value. Areas damaged by general corrosion or pitting may be evaluated by coating with brittle lacquer of proper sensitivity or photoelastic stress material. Correlation may be obtained between the hydrostatic test pressure and strains indicated by brittle lacquer or photoelastic material.

The design engineer may use the correlations to calculate the vessel's safe operating conditions.

Summary

There is no single test or combination of tests which will indicate the exact condition of a pressure vessel. However, the same condition of unknowns existed when the vessel was fabricated. It was not feasible to find the exact condition of all portions of the vessel material and weldments.

A satisfactory determination of the vessel condition can be obtained by using operating history, wall thickness, and hydrostatic testing in conjunction with other nondestructive test methods.

Continual periodic visual and wall-thickness-measurement tests are necessary to find any unknown changes in corrosion rates.

It is our conviction that testing programs of this type must be supervised by technical personnel well versed in the ASME Boiler and Pressure Vessel Code and thoroughly conversant with pressure-vessel design and nondestructive-testing techniques.

Reference

1. Lautzenheiser, C. E., "Corrosion Tests Speeded by Ultrasonics": The Oil and Gas Journal, Vol. 59, No. 1, p. 88 (Jan. 2, 1961).

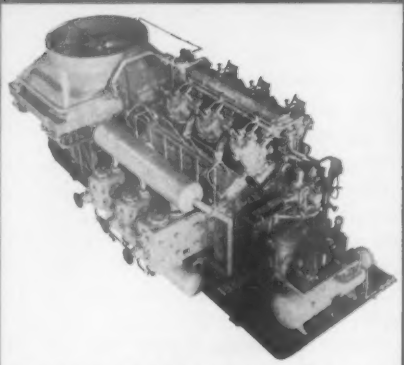
C-B/S Design-Engineered Compressor Plant . . .

Provides Balance and Efficiency For Offshore Gas Boosting, Gas Lift

C-B/Southern designed, engineered and built this 400 horsepower-rated GMXD-6 packaged compressor plant for a Southern Louisiana offshore operation. The problem was to provide a packaged compressor plant with sufficient horsepower rating to handle pressures ranging from 45 psig to 1200 psig, yet so balanced that vibration was negligible since the unit was to be mounted on a submersible 3-tier concrete barge. The natural selection was a C-B/Southern packaged GMXD-6 compressor plant.

The selection was a time-saver, too: while the concrete barge was being constructed in New Orleans the compressor was built in Houston. The compressor and related equipment were installed on the barge in New Orleans, floated to the location. The barge was sunk in place and the compressor connected to the field gas lines.

C-B/Southern and Cooper-Bessemer engineers worked closely with the barge construction people to avoid the possibility of harmful resonant conditions. This is another example of the broad service C-B/Southern offers to provide complete compatibility between the building of packaged compressor plants and operating conditions.



The GMXD-6 was engineered to produce 400 bhp. The GMXD line is also built in horsepower ranges from 265 to 825. C-B/S packaged compressor capability is proved by the 40,000 horsepower the company designed, engineered and built last year. Other packaged compressor plants are available in horsepower ratings from 100 to 1440; unitized compressors, both reciprocating and centrifugal, to 10,500 hp.

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Plotting equilibrium curves

CURVES in Fig. 4 apply to hexane-heptane mixtures. However, such curves can be plotted for other mixtures such as butane-pentane and so forth. From the equilibrium curve, we can determine the vapor composition above a boiling hexane-heptane mixture of any percentage composition.

The partial pressures exerted by fractions in a mixture determine how easy it is to separate the fractions. The greater the difference in partial pressures of the fractions of a mixture, the easier it is to separate them by distillation. We have pointed out that distillation involves vaporization. Of course, to vaporize a liquid, we have to heat the liquid up to its boiling point.

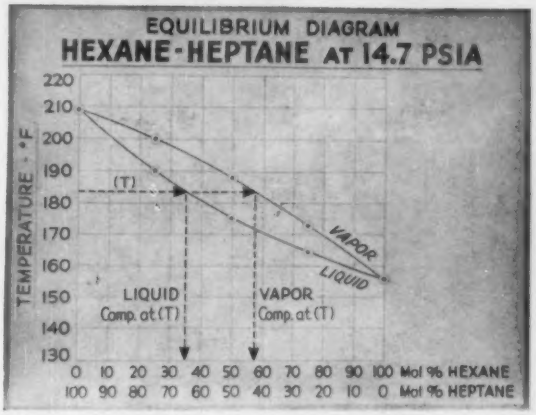
TABLE 1

Liquid—	Temp. (°F.)	Vapor pressure (psia.)
Water	32	0.1
	100	1.0
	212	14.7
Butane	31	14.7
	100	51.5
Hexane	175	20.6
Heptane	175	8.8
Benzene	176	14.7

Boiling points. In Table 1, note that at the normal boiling of water (212° F.), its vapor pressure is 14.7 psia. From the same table, note that benzene has a vapor pressure of 14.7 psia. at 176° F. What does this mean? It means that whenever the vapor pressure of a liquid is equal to the pressure being exerted on the liquid, the liquid will begin to boil. Therefore, the normal boiling point of benzene is 176° F.

Since the vapor pressure of a liquid changes with temperature, it means that any liquid has an infinite number of boiling points, depending on the pressure exerted on the liquid. The higher the pressure, the higher the boiling point; the lower the pressure, the lower the boiling point. Table 2 gives the boiling points of some familiar substances at atmospheric pressure.

This material taken from process-training-program manual, Bayway, N. J., refinery of Humble Oil & Refining Co.



EQUILIBRIUM curve shows the vapor composition above any liquid mixture of heptane and hexane. Fig. 4.

TABLE 2

	Boiling point (°F.)
Pure compounds:	
Water	212
Pentane	97
Benzene	176
Heptane	209
Dodecane (C_{12})	421
Mixtures:	
Gasoline	75- 430
Heating oil	300- 600
Crude oil	75-1,400

Note that when boiling points are given for mixtures such as gasoline or heating oil, a boiling-point range is given. This is because gasoline, for instance, is a mixture of pentane, benzene, dodecane, and hundreds of other pure compounds, all having different boiling points.

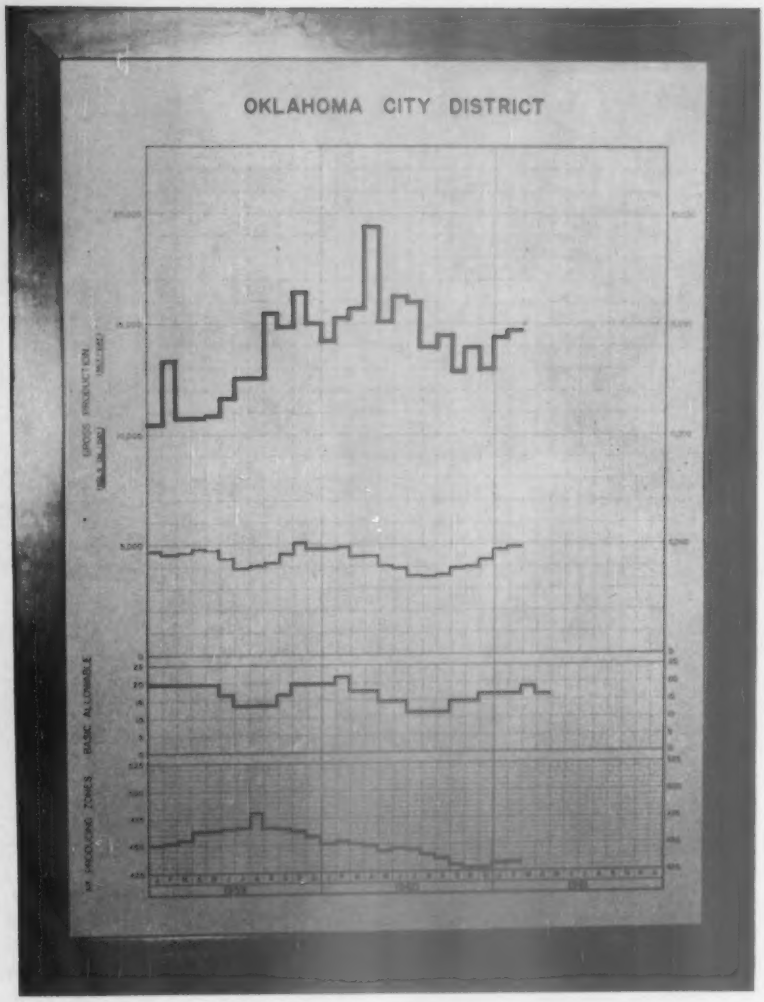
Condensation. Water will vaporize at 212° F. (14.7 psia.), and the vapors (steam) can be completely condensed at the same (211° F.) temperature. This is not true for a liquid mixture.

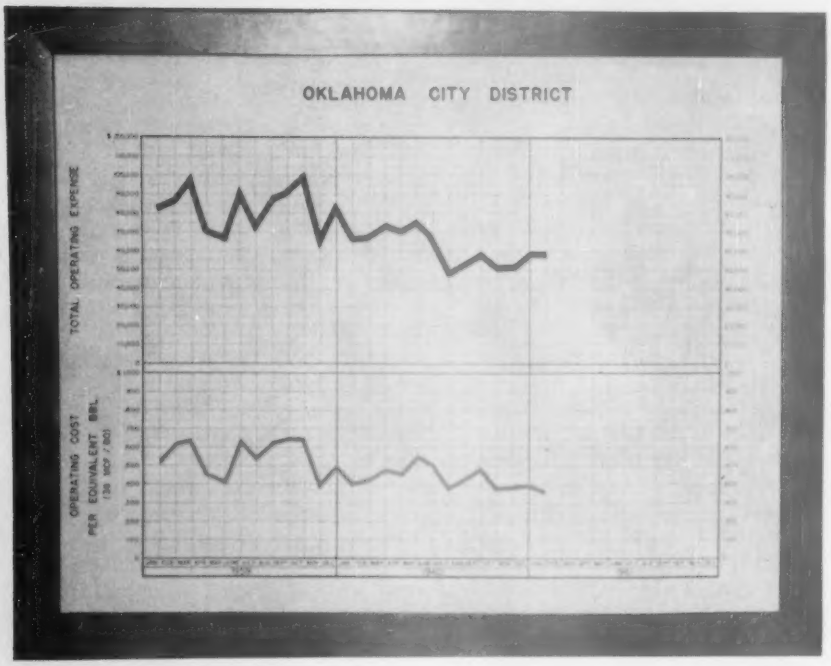
For example, look again at Fig. 4. A 50-50 mixture of hexane-heptane will start to boil at 175° F., the bubble point. From the curve, note that the vapor composition above the liquid would be 70% hexane—30% heptane. If we started to cool the vapors below 175° F., condensation would begin. The temperature at which the first droplets of the vapor condensed (in this case 174°+ F.) is called the dew point of the vapor mixture.

However, at 174°+ F., we would find that only a small amount of the vapors would condense. To get complete condensation of the vapors, we would have to lower the temperature considerably below 175° F. How low? Refer to Fig. 4 and you will see that for a 70% hexane—30% heptane liquid mixture, the initial boiling point or bubble point is 165° F. The vapor composition above a 50-50 hextane-heptane mixture is 70% hexane—30% heptane.

Upon condensing these vapors, we would have a liquid mixture of this composition. Therefore, it follows that we would have to lower the temperature of the vapors (70% hextane—30% heptane) to the bubble-point temperature of a 70-30 hexane-heptane liquid mixture. This from Fig. 4 is 165° F. For a pure material, such as water, the dew point is the same as the bubble point or 212° F. at 14.7 psia.

In explaining vapor pressures, partial pressures, dew points, and so forth for mixtures, we have used only two-component mixtures as examples. This was done because it is possible to easily calculate these significant pressures and temperatures. However, when working with complex mixtures, such as crude oil, it is much more difficult to calculate such pressure and temperature values, and, of course, would be much more difficult to explain. Nevertheless, the same principles apply. Directionally, the same liquid-vapor composition changes occur whether heating or cooling a two-component or any other multi-component mixture.





How to cut operating costs 20%

Through concerted effort, Tenneco Oil Co. has managed to trim expenses by more than one-fifth. Company-wide cost-cutting programs, with free exchange of ideas among operating districts are responsible for the sharp drop in expenditures.

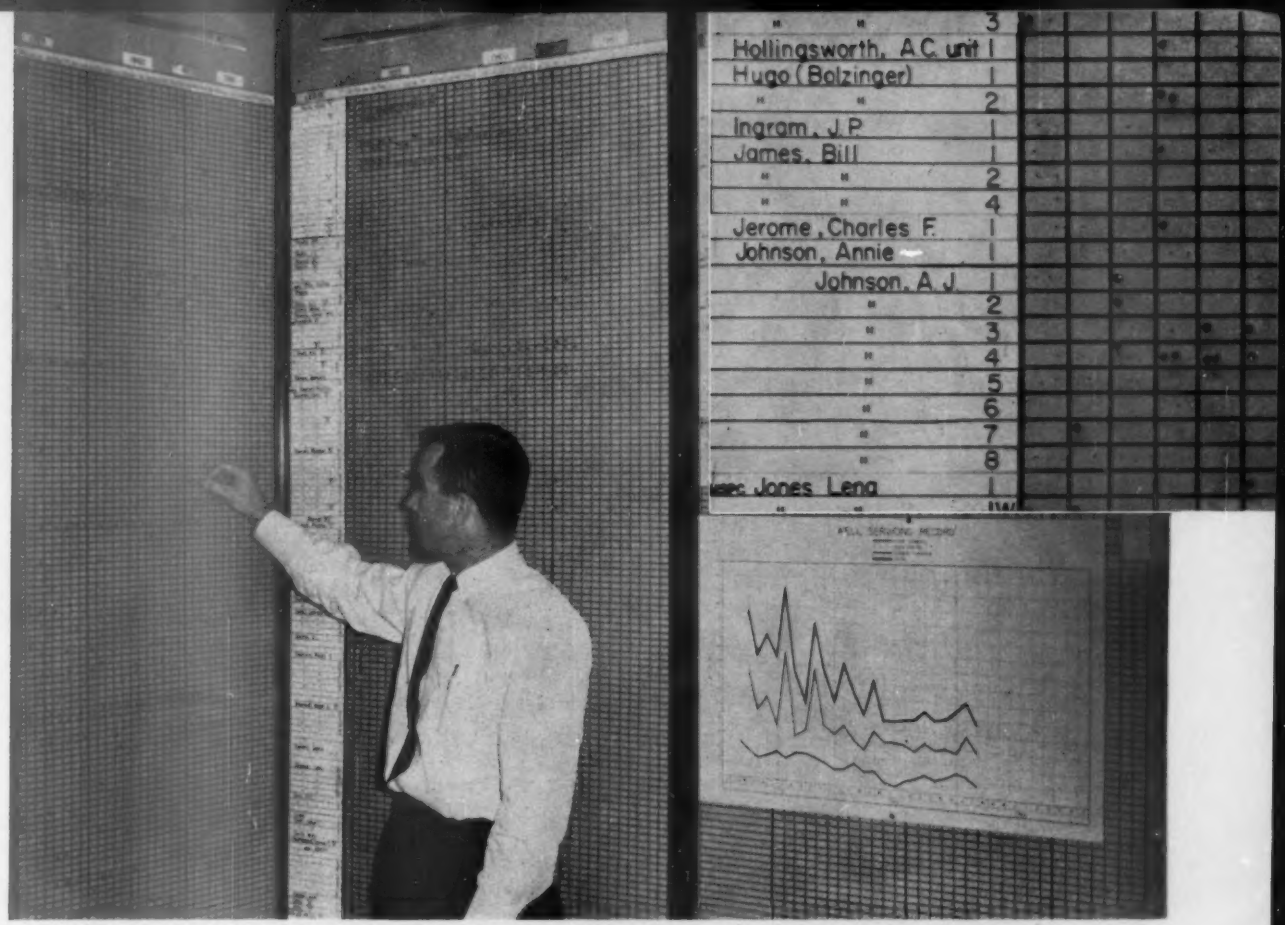
BY W. B. BLEAKLEY
Production Editor

OPERATING COSTS are down by more than 20% on the average for three districts of Tenneco Oil Co.'s Rocky Mountain division.

It hasn't been easy, but it has been done. Some of the methods used are:

- Contract pumping.
- Contract maintenance.
- Contract well repair.
- Contract warehousing.
- Preventive and corrective maintenance.
- Daily check on costs.
- Planned cost controls.
- Free intracompany communication.
- Realistic look at workover expenses.
- Automotive-fleet streamlining.

WALL CHARTS like these are used to keep a constant check on company operations in the Oklahoma City district office. Chart at the top shows production data; average barrels oil per day, average volume of gas per day, basic allowables, and number of producing zones contributing to total production. Chart at left is a constant reminder of operating expense. It shows a monthly total for the district, and a record of costs per barrel of oil, or gas equivalent.



WELL-SERVICING BOARD shows all repair jobs on Tenneco wells. Pins of various colors are used to show rod parts, tubing leaks, etc. Paul H. Lenhart, Oklahoma City district production superintendent, is posting a change in well condition by inserting a pin of the proper color. Chart on the right is a summary of well condition as shown on the big board. Inset is a detailed section of a portion of the board.

With only 23 employes in the Oklahoma City district, Tenneco operates properties producing 5,000 bbl. oil per day from 406 wells in 436 zones (some dual completions) and operating expenses are less than $60,000 per month!

Tenneco Oil Co. conducts exploration, production, refining and marketing operations in the U. S., Canada and five other countries, with headquarters in Houston. Its parent firm, Tenneco Corp., was formed recently to own all the nonpipeline properties of Tennessee Gas Transmission Co.

One of the big contributing factors is communication. The office force and field personnel are in constant touch, so each knows what the other is doing. Periodic meetings are held to keep supervisors informed of all operations, and to provide an opportunity for a free exchange of ideas on how to shave expenses.

Training sessions add to the knowledge of all hands, and these are held periodically.

What's been done. First step in the cost-cutting plan was to put all pumping on a contract basis.

Under this plan all pumpers are employed by a pumping contractor, and Tenneco foremen give no direct orders to the pumpers. Their operating ideas are transmitted through contract foreman, furnished by the pumping contractor, who passes the word down to the pumper in the field.

Since the pumpers are not employed by Tenneco, there are no personnel records to maintain and no clerical expense for handling time sheets and pumper mileage.

But Tenneco is not contributing to joblessness. Many former employes are working on their old jobs, but for a different employer.

How it works. Tenneco's deal with the pumping contractor is set up on a "work unit" basis. Under this plan each well, tank battery, pump, compressor, etc. is given a "unit value." The size of the unit varies with the amount of attention required by each item in the field. A pumping well, for example is assigned one unit; a flowing well ¾ unit, and so on, Table 1.

Each work unit has a dollar value agreed upon in the contract. Once set, this value cannot be changed without negotiation between the contractor and Tenneco.

At the end of each month, the amount to be paid to the contractor is found by totaling the number of units in the district, and multiplying by the value per work unit.

Advantage of this plan is that

TABLE 1—UNIT VALUES FOR CONTRACT PUMPING AND MAINTENANCE WORK

Pumping well	1
Flowing well	¾
Salt-water-disposal well	½
Injection pump	½
Pumping jack	½
Pump power	1
Gas well	¾
Tank battery	½
Kobe unit-power	1
Kobe well	1
Water-supply well	1
Water-injection well	½
Gas-lift well	¾
Compressor	1

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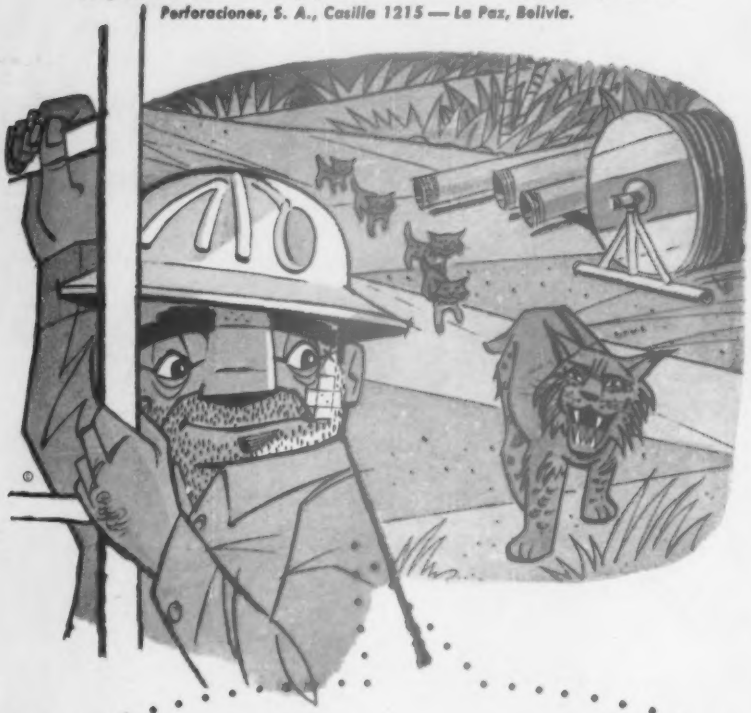

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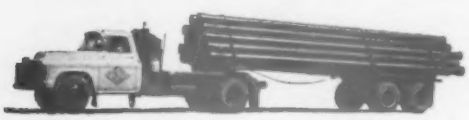

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any change in the number of work units, such as a well going off production, or a change in producing status of a well, is immediately reflected in operating costs. This works both ways, too. If a well is taken off the production schedule, Tenneco pays less; if a new well is drilled and put on production the contractor gets paid more.

Contract warehousing. Arrangements are being made with a major supply company to take over the warehousing job for Tenneco in the Oklahoma City district. With this plan there will be no warehouse to maintain, no stock record cards to keep, no warehouseman to pay, no trips to the warehouse to pick up equipment, and no inventory of expensive tubular goods, unit pumpers, etc.

Under the terms of the agreement, the warehousing company's used-equipment section will buy all equipment that is surplus to Tenneco, pick up the equipment and move it to its yard, and then offer it for sale to any interested party. If Tenneco finds a need for the item, it can be bought for the original price paid by the warehouse, plus a handling charge and a predetermined percentage markup that represents a reasonable profit to the warehouser.

In addition to the advantages already mentioned, this plan puts the source of Tenneco's supplies within a reasonable distance of every field operation—something that one company warehouse couldn't do.

Where management comes in. Responsibility for cost cutting rests squarely on the shoulders of management personnel. Primary responsibility is in the office of the district production superintendent.

Tenneco has three operating districts in its Rocky Mountain division: Oklahoma City district, Paul H. Lenhart, superintendent; Great Bend district, Glenn E. Armour, superintendent, and the Casper district, Bob Bodemann, superintendent. Division headquarters are in Denver, with D. B. Johnson as division production superintendent.

Each superintendent maintains the needed records to keep his eye on total operating expenses. These records act as the primary control,

Table 2—Reduction in Tenneco Operating Expenses, Rocky Mountain Division, by Districts, 1960 Over 1959.

District	% Reduction
Oklahoma City	23.7
Great Bend	19.9
Casper	17.1

and decisions are made after analyzing these control items.

For example, the Oklahoma City office houses a well-servicing board, a chart of production versus allowable, and a chart showing total operating expense and operating expense per barrel of oil or gas equivalent.

The well-servicing board shows all subsurface well-servicing jobs. A system of colored pins is used to show pump changes, rod parts, paraffin scrapping, tubing leaks, etc. Each of the districts 406 wells is on the board.

Frequency of jobs, shown by too many pins of the same color, is an alarm signal to the office staff, and a detailed study is made of the offending well to locate the cause of the trouble.

For example, if a well shows several rod parts in sequence, the engineering study will include weighing the well, and running all other tests deemed necessary to prevent future rod trouble.

In use for the past 2½ years, the board is located in the office of the district production foreman. He is in charge of all field work and is in daily contact with the company and contract foremen in the field.

Other graphic records. Over-all control of operations is shown visually on other wall charts. The district superintendent can tell at a glance whether or not the district's production is where it should be. One line on the chart shows daily average production, and another shows allowable. If the lines go up and down together, there is no problem, but if the production line falls off, and the allowable line remains level or goes up, the superintendent knows that something needs attention.

If the trouble is not immediately apparent, a meeting of supervisors is held, and steps are taken to bring production back to the allowable level. Comparable cost and production controls are maintained in three district offices and division office.

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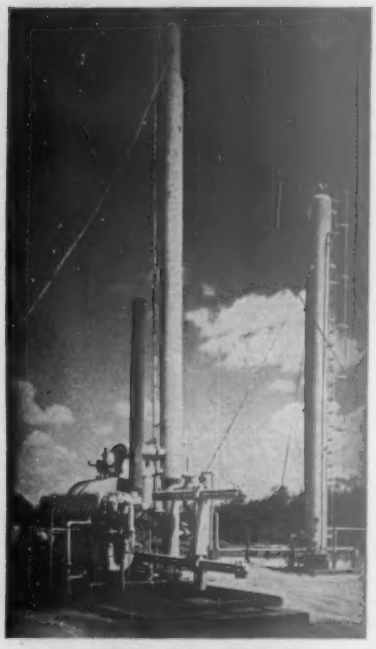

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At regular meetings of supervisors, all outstanding work is discussed. Workovers, repairs, etc., are given individual attention and a priority is assigned to each job. High priority is given to those jobs that will yield the greatest rate of return. No workover is performed if the payout period is greater than 4 months.

General Tenneco outlook is that workovers are a poor investment. Best rate of return comes from recompletions.

But Tenneco isn't giving up on workovers. In fact, the new allowable rules in Oklahoma, favoring deeper production, have made the Oklahoma City district office take a second look at proposals considered unfeasible under the old allowable setup. All deep-well workover possibilities are being reevaluated.

Marginal wells. As a further check on expenditures, Tenneco maintains a series of marginal-well economic - analysis forms. These forms, completed copies of which are sent to the men in the field, show how much expense, above normal, can be charged to each well. If a job is going to cost more than this amount, the foreman must get authority from the district office before proceeding with the work. The district office either approves the repair job, after additional study, or the well is recommended to management for recompletion or plugging and abandonment. Maximum expenditure above normal is set up on a 3-month payout with continued profit after that time.

Other methods. Total operating expenses, shown on another wall chart, are broken down into smaller units on graph paper. These are used as primary controls and can be referred to when the total operating expense line seems to be getting out of hand. They show lease cost of various items such as lease fuel, chemicals, well equipment and well servicing, etc. Targets for total operating expense for each district are set by the division office.

In one instance, a leak in a fuel line developed and was not detected by the foreman on the job. It went unnoticed until the fuel bills were received the next month. The sharp break on the fuel - expense

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curve was immediately obvious, and the leak was repaired without delay. Without breaking the cost items down into smaller units, this leak may not have been found for a longer period of time, resulting in a waste of money.

Tenneco does not own any pickup trucks. Transportation costs have been greatly reduced under contract pumping operations.

All of Tenneco's pump repairs and surplus pump storage in the Oklahoma City district have been concentrated in one pump-repair shop. This gives better control over repair, and the quality of the repair jobs is maintained at a constant level. And Tenneco's inventory of pumps is smaller.

In the Rocky Mountain division, where production is 8,600 bbl. per day from properties operated by Tenneco, the efficiency of operation has been found as good or better than it was when the company employed all its own help.

Great Bend district. While most operations are uniform throughout the company, there may be slight differences due to individual field problems.

In the Great Bend district, corrosion of tubing and casing has been an expensive item. But in handling this and other problems, preventive maintenance is the watchword.

Corrosion inhibitors are used regularly in troublesome wells. Treatments are on a regular basis, and no scheduled treatment is missed unless the weather is too bad to get near the well. Long-term treatments are being evaluated, and if found successful, the interval between treatments will be stretched to 1 or 2 months or more.

Tests have also been conducted to find out just how much inhibitor is needed to mitigate tubing and casing corrosion. Too much inhibitor means waste, and not enough means costly repairs.

Cathodic protection has been installed on some wells to prevent casing corrosion. Both the anode and the generator types have been used, depending on local conditions.

Overloaded equipment is more likely to break down than equipment that is sized properly for the job. With this in mind, Tenneco engineers have made equipment studies to be sure the right equipment is on the right job.

Pumps standardized. Over the last several months the number of different pump types in use by the company has been cut down. This is the first step in standardization of pump types, and changes will be made as soon as possible without interfering with normal operation.

Result of this step is that field personnel will become familiar with the one or two types of pumps in use, and will be able to better understand the operating problems. Further, repair costs will be cut because of interchangeability of parts.

Well pleased. With operations as efficient as or better than before, and with a drop in over-all operating expense of the order of 20%, Tenneco personnel are well pleased with their accomplishments. And they should be!

But there is no letup yet. The line will continue to be held by watching expenditures, evaluating all well repairs, and finding cheaper and better ways of doing everything.

HOW 116 OIL WELLS WERE PROTECTED FROM CORROSION

Several leaks, caused by external casing corrosion, had already occurred in this Permian Basin field of 116 wells. No previous attempt had been made to stop the corrosion.

To determine the current required for protection, CSI spot checked 25 of the wells—using the "log current potential method" developed and patented by a CSI engineer.

It was found that a maximum of 6 amperes was sufficient to stop corrosion. However, it was decided to use 8-ampere rectifiers as the current source so that there would be a reserve to meet changing requirements caused by weather. In some instances it was found advisable to install 16- and 24-ampere rectifiers to protect 2 or 3 wells in groups.

CSI's experienced crews handled the complete installation, furnishing the rectifiers, all other necessary materials and equipment, plus a full report.

You will find CSI an economical, reliable source for engineering and installation services; and for cathodic protection supplies including Dow magnesium anodes.

CSI

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1309 Washington Ave.
Tel. CHerry 1-7795

CORROSION SERVICES INCORPORATED
General Office, Tulsa, Okla.
Mailing Address:
Box 787, Sand Srings, Okla.
Tel. Circle 5-1351

BY W. L. NELSON, Technical Editor and Petroleum Consultant

Billion-dollar process changes come again—and again

THE administrative staff of a petroleum refinery is constantly required to assess the changes in process methods that are continuously made available. In the last 100 years there have been at least 116 noteworthy changes[1 7 9] and at least 70 of these required major expenditures of capital. Process changes have occurred at the rate of about 1.5 per year[11] during recent years (1920-1960) and changes will probably appear in the immediate future at the rate of 2 to 3 per year (as during 1930-1942).

To management the changes now mean nearly a billion dollars a year in capital investment[14], some for natural growth of the industry but mainly for necessary enlargements, quality improvements, efficiency improvement, and obsolescence.

Although everyone hopes to imagine and foresee the next vital change, costly mistakes have been made, as witness the rapid obsolescence in cracking processes during 1925-1935, or the commercial development of at least six solvent-extraction processes (1928-1940) which are not among those now used. Thus in order to progress in an orderly manner, management must not only consider the future but should note what average expenditures have been required in the past[12 14] as a guide to what the next 10 years will bring.

Obsolescence, improvements, enlargements, maintenance, depreciation, amortization, etc., are so intimately interrelated[15] that many pages are required to explore and explain the situation (see 15 references in The Oil and Gas Journal all by W. L. Nelson). Process changes were investigated in detail on Questions on Technology pages[1-6] and the changes were classified according to (1) crude distillation and cracking processing[1 4] (symbol "D" used to label such changes), (2) gas recovery[2], (symbol "G"), (3) lube manufacture[5] (symbol "L"), (4) light-oil treating[3] (symbol "T"), (5) octane-number improvement[6], and chemical manufacture (symbol "C"). Each of the changes or innovations was carefully considered so as to judge whether it involves obsolescence[10 13], or only an improvement in quality or efficiency[8 9 11 12], as well as to assess cost of enlargements in capacity and the effect of changes in demand[8 9 14 15].

The tabulation of Process Costimating No. 90, March 6, 1961, p. 143 ("What's the Price Tag on Higher Quality and Improved Refinery Efficiency?") is a summary of the situation and it created so much interest that each column of the tabulation will be discussed here in detail:

Column 1. Year at which innovation or change was thought to be widely accepted by industry. Obviously the innovation had to be introduced during a period of years centering (presumably) about the date shown.

Columns 2 and 3. Refinery construction cost during the year of Column 1 for light oil (L.O.) or fuel-type refineries, and for lube refineries.

Column 4. Name of change or innovation. As an example "viscosity breaking" was first widely used in 1939 at which time the cost of light-oil refineries was about $300 per daily barrel and lube refineries $620 per barrel. Renewed need for viscosity breaking (in connection with catalytic cracking) occurred in about 1950, and hence it is introduced again in 1950 using the word "more" to indicate a second and further use of viscosity breaking.

Columns 5-9. These columns all headed "Percentage of crude capacity involved" permit computation of the barrels per day of capacity installed. Thus for V.B. in 1939, about 80% of the refineries (Column 7) adopted viscosity breaking (or its equal in black-coil cracking) and the V.B. capacity was about 20% as much in L.O. refineries as the crude capacity (Column 5) but only 10% in lube refineries (Column 6).

Columns 8 and 9 are the product of Column 5 or 6 and Column 7 to show the capacity of the innovation compared with the total refinery capacity.

Columns 10 and 11. These show the per barrel cost of the process (innovation) during 1946 which is the best known date for establishing costs (see Costimating Series), and at the actual date (Column 11) by use of the Nelson Refinery Construction Cost Index (published in first issue each month of The Oil and Gas Journal).

Columns 12 and 13. The product of the per barrel cost (Column 10 or 11) and the barrels or percentage involved (Column 8 or 9) is the cost of the innovation per barrel of crude-oil capacity—for V.B. in and about 1939, $12.30 for L.O. refineries but only $6.15 for lube refineries.

Columns 14 and 15. These last columns are innovation costs as percentage of plant replacement cost (Column 2 or 3). During the entire 81 years of the tabulation the cost due to changes is 296% for L.O. refineries and 229% for lube refineries, or an average of 3.66% and 2.82% per year.

Certain changes not only require expenditures but they also cause obsolescence, and the cost of obsolescence[13] was investigated in a tabular way in Process Costimating No. 92. These two costs, improvements and obsolescence, (as well as enlargement costs) are summarized[14] in Process Costimating No. 97 which shows average improvement and obsolescence costs for 20 years up to the date shown, as percentage of refinery replacement cost. Finally, an attempt was made[15] in Process Costimating No. 99 to show the relationship between these costs and such cost elements as depreciation, interest on investment, inflation, and maintenance.

All of the references are by W. L. Nelson and they were published in The Oil and Gas Journal.

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7. Process Costimating No. 76, 100 Years of Processing Advances, July 25, 1960, p. 204.
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10. Process Costimating No. 86, Refinery Obsolescence Costs are not Excessive, January 2, 1961, p. 86.
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12. Process Costimating No. 90, What's the Price Tag on Higher Product Quality and Improved Refinery Efficiency?, March 6, 1961, p. 143.
13. Process Costimating No. 92, Cost of Refinery Obsolescence, April 17, 1961, p. 113.
14. Process Costimating No. 97, Capital Expenditures of the Refining Industry, June 26, 1961, p. 153.
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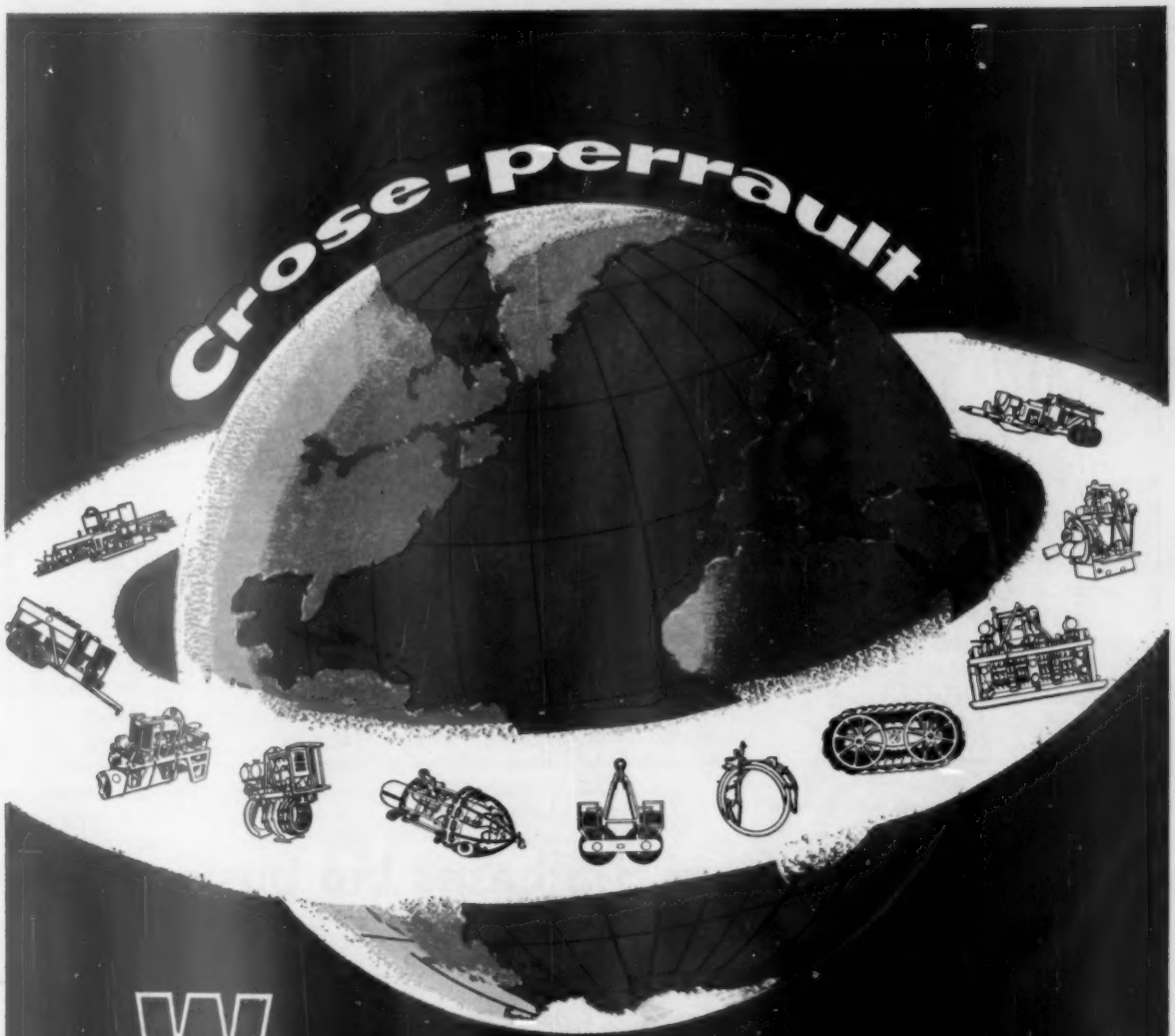

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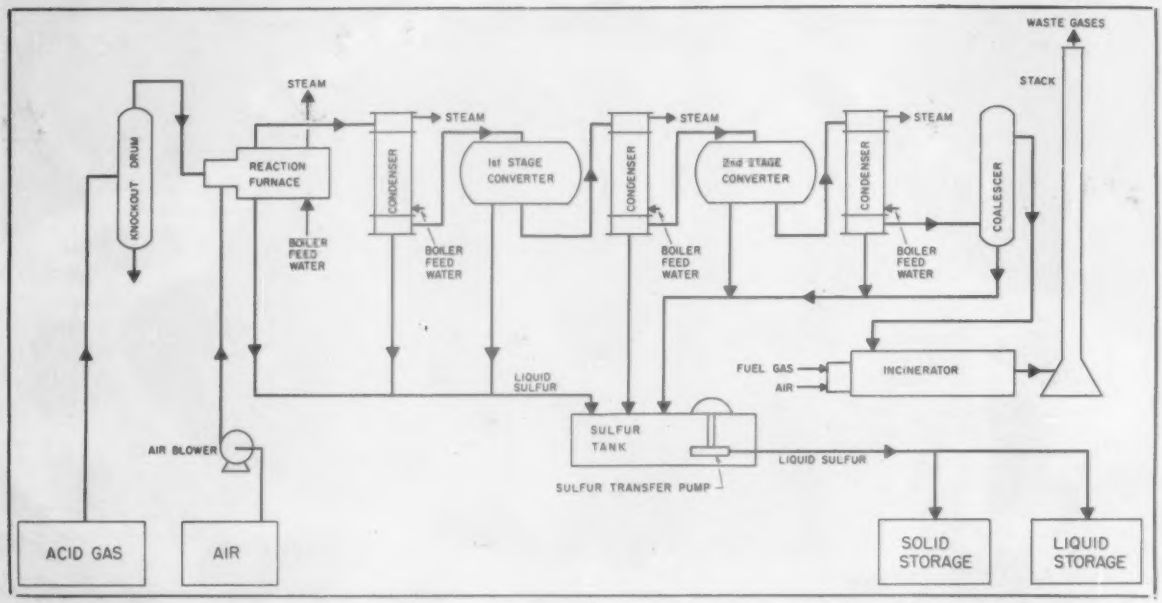

PETROLEUM-DERIVED SULFUR is usually obtained using some variation of the Claus process. This is the flow pattern for the process designed by Ralph M. Parsons Co.

Sulfur recovery from H_2S gases big business

SULFUR produced from sour natural gas, acid refinery gases, or H_2S-rich process gas now accounts for about 15% of the world's supply. Some variation of the Claus process has been the usual route to recovering sulfur from these sources. One of the most widely used variations of this process was designed by Ralph M. Parsons Co. and is described here.

Process description. Partial combustion of H_2S takes place, with a high release of heat, in a specially designed reaction furnace where approximately 60% of the conversion takes place. The combustion gases are cooled by generating steam, thereby condensing sulfur which is removed at the reaction furnace outlet. The remaining gases then pass through two stages of catalytic converters and condensers. Entrained sulfur compounds in the tail gases are then converted to SO_2 in the incinerator before being discharged from the stack.

Operating data. Sulfur normally produced is 99.9% pure, is of bright yellow color, and can be delivered in solid or liquid form. Plants of this design can normally be operated at capacities from 25% to over 100% of the rated capacity. The process can be applied economically to acid-gas streams containing from 15 to 100% H_2S, in capacities from 5 to 1,000 long tons per day.

Some plants have been in operation 5 years on the original charge of catalyst with no appreciable decrease in yields. In addition, it is an important method of air-pollution control. Ninety-five per cent of the sulfur that would normally be discharged to the atmosphere in the form of SO_2 is recovered.

Steam can be produced at the reaction furnace at pressures up to 600 psig. in quantities sufficient to supply the blower requirements of the plant. An excess of 50-psig. steam can be made which will supply all heating requirements of the plant, and, in some instances, all the heating requirements of an H_2S-removal plant preceding the unit. If blowers are powered electrically, high-pressure steam is available for elsewhere.

All equipment and lines are carbon steel except for burners.

Heavy fuel is good coke substitute in blast furnaces

HEAVY FUEL OIL may invade another of coal's traditional markets—the steel industry.

Bunker C fuel is proving quite satisfactory as a partial replacement for coke at one Canadian blast furnace. Just how widespread the practice becomes, however, will depend upon the relative prices of the two fuels.

First commercial use of fuel oil as a coke substitute is being carried

TABLE 1—RESULTS WITH HEAVY-FUEL-OIL INJECTION

	Base coke period, Nov. 3-12, 1960	Inj. 840 gal. oil per hour, Dec. 3-14, 1960
Iron production, net ton of hot metal per day	1,165	1,214
Net coke rate, lb. per net ton of hot metal	1,503	1,328
Net oil rate, lb. per net ton of hot metal	0	133
Charges per day	135	127
Burden ratio, lb. ore per lb. coke	2.18	2.58
Oil used, 1,000 lb. per day	0	161.7
Coke saved, 1,000 lb. per day	0	212.8
Lb. oil used per lb. of coke saved	0	0.76
Furnace conditions:		
Blast temperature, °F.	1,438	1,561
Blast pressure, psi.	19.4	21.1

out in a 22-in.-diameter blast furnace of Dominion Foundries & Steel Co., Ltd. (Dofasco), at its Hamilton, Ont., steel mill. Full-scale tests were started last November after a test program by Esso Research & Engineering Co. indicated coke savings would be possible.

Use of oil as a supplement is permitting Dofasco to operate at a net coke rate of less than 1,200 lb. per ton of iron produced. This compares with some 1,500 lb. per ton when operating with the conventional coke charge.

Over-all savings, when considering the fuel oil consumed, appears to be about 100-125 lb. of coke per ton of hot metal produced . . . a savings in the range of 5-10%. This is realized while firing about 600 bbl. daily (1,100 gal. per hour) of Bunker C fuel, a rate which reportedly gives the best results.

Based on these limited experiences, the potential market for fuel oil in such use would be in the range of 125,000 - 150,000 bbl. daily. This figure is arrived at by projecting Dofasco's oil-steel ratio to this year's U. S. iron production.

Earlier test results. Operating results at lower rates of oil injection were described recently by W. R. Rombough of Dofasco at a Philadelphia meeting of steel producers. Portions of the data, which Rombough said didn't represent the best performance possible, are given in Table 1.

Compared to operations with a normal coke charge, injecting fuel oil at an 840-gal. per hour rate (133 lb. per net ton) resulted in a coke savings of 175 lb. per net ton of hot metal. This represents an uncorrected replacement ratio of 0.76 lb. of oil per 1 lb. of 91% carbon coke.

However, during the period when no oil was used, the charge contained 11% more beneficiated material, more scrap, and lower slag volume. Also the silicon content of the hot metal averaged 0.1% lower. Thus considering these differences, the corrected oil-to-coke replacement ratio is about 0.6 to 0.65 lb. of oil per pound of coke.

The fuel oil charged had a sulfur content of about 2.25%, resulting in a 20% higher sulfur input than when the coke alone was used. This had no significant effect on the sulfur content of the hot metal, however, indicating sulfur doesn't show up in the hot metal in the same proportion as sulfur is added to the burden.

The test was halted so that a better burden could be obtained. Rombough noted, however, that the furnace ran just as smooth with the higher blast pressure and higher burden ratio when using oil as it did when operating on coke only.

Operating benefits. Oil injection adds a new tool for the control of blast - furnace operation. As Rombough pointed out by merely changing the setting on the oil flow controller:

Fuel input to the hot working zone of the furnace is varied, as opposed to waiting several hours for an equivalent burden change to have the same effect.

Rate of stock movement down the furnace shaft is changed by reducing the rate at which the coke is burned.

Raise or lower temperature of the tuyere (air-injection) zone, and in turn the furnace hearth temperature, through utilizing the higher fuel value of the oil.

Valve clamp speeds repairs

VALVES are bolted down during reconditioning but may need repositioning many times before the job is complete. Each time the valve is repositioned there is a chance for barked knuckles and mashed fingers because of the unbolting and rebolting.

A new clamp that eliminates bolting was devised by the pipe shop at Dow Chemical Co.'s Freeport, Tex., plant. Also, the new clamp saves the time formerly spent making the bolts fast. The clamp is a two-arm lift mounted on an air chamber with a three-way control. The two arms work on each side of the breakdown table and can be moved up, down, or sideways. The clamps (photo—circle) fit over the valve base into holes in the table.

Now, with a touch of the air-pressure handle the valve is clamped in position.

UNIBOLT PRESSUREMATIC WING VALVE

stands guard around the clock . . . and permits choke changing, too

The new UNIBOLT Pressurematic Wing Valve is an adaptation of the tried and proven UNIBOLT Adjustable Wing Valve with an added automatic closing feature. (Any Adjustable Wing Valves now in Christmas tree and other services may be readily converted to "Pressurematics" by replacing the standard stem/bonnet assembly with the new automatic assembly.)

Heretofore, in order to protect a well against broken flowlines and similar mechanical failures that would permit the well to flow wild, an automatic "high-low" valve has been installed in the manifold beyond the wing valve. Now, a single Pressurematic Valve not only safeguards the well against these hazards but also serves as a fine, easy-operable wing valve.

NO SPRINGS—The design is simple and trouble-free.

PRESSURE SURGE OR DROP CLOSES VALVE—Once the well head and flowline pressures are established, it is an easy matter to determine the automatic operating range of this valve. Then, when pressures rise or fall beyond predetermined limits, the valve closes instantly, automatically.

CLOSES EASILY BY HAND FOR CHOKE CHANGING — Unlike all other "high-low" safety valves, the Pressurematic Valve is an excellent Christmas tree wing valve. A few turns of the handwheel closes it for choke changing. Then, the valve is opened and set for automatic operation by further manipulation of the handwheel.

IT SAVES YOU MONEY—This combination automatic shut-off and wing valve costs little more than the price of a good wing valve or a conventional "high-low" valve alone.

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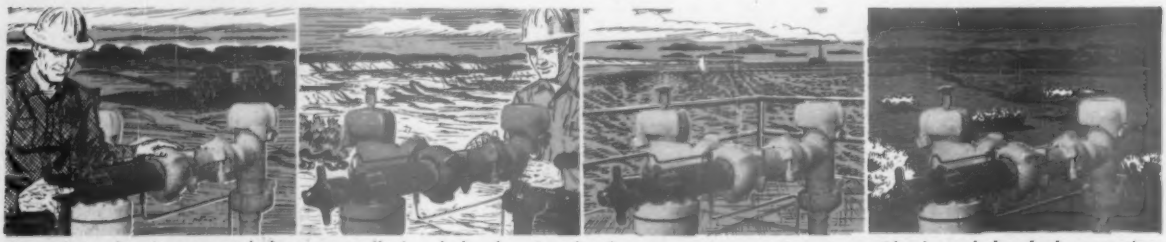


As a wing valve, it opens and closes manually for choke changing. Set for automatic operation, it provides 'round the clock protection.

On the Job

PIPELINING

Huge map pictures vast expansion project

Floor-to-ceiling map is updated daily to keep Northern Natural's operations, engineering, and construction divisions advised of progress on 4-state, 1,100-mile project.

A MAMMOTH expansion program going into four states tops Northern Natural Gas Co.'s construction activity this year. It will extend its system to 178 communities, some of which will get gas for the first time this year, the others in 1962.

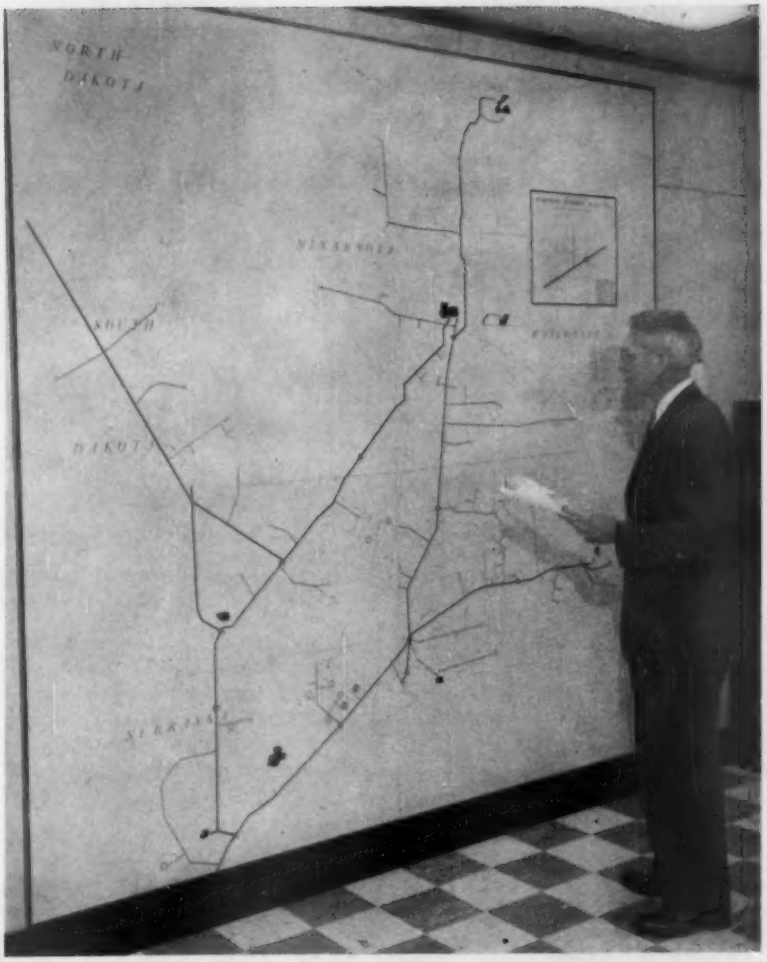
These communities are spread over parts of four states: Iowa, Minnesota, Nebraska, and South Dakota. Serving them involves the construction of 1,100 miles of pipelines ranging from 2-in. to 10-in. diameter.

Northern Natural will also construct a 63.2-mile, 16-in. line from Duluth to Silver Bay and Two Harbors, Minn. All projects are scheduled for completion this year.

To keep personnel in the main office in Omaha appraised of the progress of the program, a 64-sq.-ft. map, 8 by 8 ft., has been installed near the offices of the Operating and Engineering Construction Divisions. Employes of these departments use it for construction control.

The map locates all of the branch line and town-border-station construction work in the four states, the Duluth-to-Silver Bay project, and a proposed extension to Janesville, Wis., to connect with the Michigan-Wisconsin system. Construction on loop lines and compressor stations is also noted.

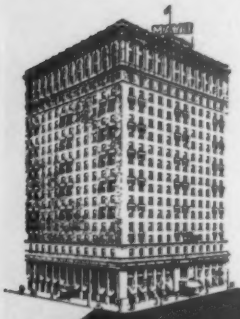
Construction progress on each



PROGRESS AT A GLANCE. Vern Wagner, construction, studies 64-sq.-ft. map which is updated daily to show progress on Northern Natural's vast expansion project.

DAILY PROGRESS REPORTS are phoned in from construction headquarters in the field. Ralph Den, director of pipeline construction, looks at reports posted by map for ready reference.

THE HOTEL



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CONSTRUCTION PROGRESS is recorded by percentages. Thus a glance at the map gives an immediate picture of how work is progressing. Beverly Huey uses colored pencil to adjust figures on one project.

line or station is recorded by percentages so that a glance at the map gives an immediate picture of how work is proceeding. It also provides an integrated view of the widely scattered operations.

The map, conceived and drawn up by Dick Thatcher of the Drafting Section, is kept up-to-date from Daily Progress Reports phoned in from the several construction headquarters in the field. These reports are posted on either side of the map for reference as needed.

Right-of-way policy set by gas company

RIGHT-OF-WAY encroachment can be a source of real trouble for pipeline companies. One of the major gas companies has set down a policy for its superintendents to follow in order to forestall such problems as much as possible.

That policy, covered in a memorandum to all superintendents, follows:

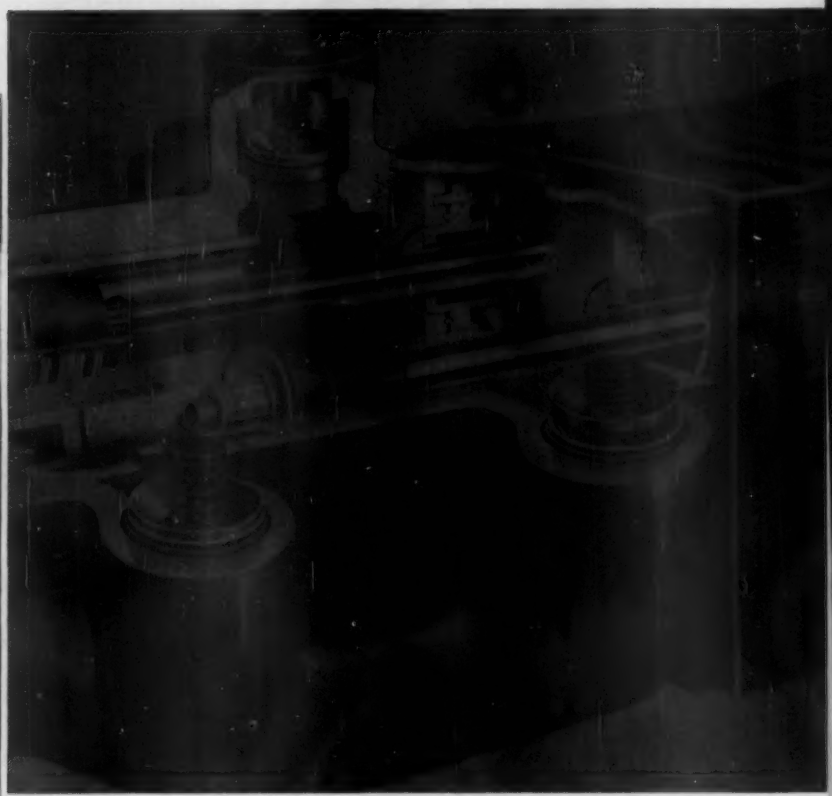
"In dealing with the possible encroachment of others on our pipeline right-of-way the delay in taking definite action, or advising others of our usual right-of-way requirements, has resulted in some difficult situations. Structures have been placed too close to our pipe lines before the notification letter from the region, giving details of the proposed construction, was cleared through this office.

"Preliminary action must be taken early to discourage construction so close to our pipe lines for repair and maintenance purposes. We have adopted the general rule that no building, or similar structure should be constructed within 30 ft. of our lateral lines, or within 50 ft. of the main lines; also, that no paved portion of any parking lot be constructed over the pipelines; and that no streets be constructed longitudinally over our lines. The construction of dams, so as to flood the right-of-way over our pipe lines, is another type of encroachment which should be prevented. In applying this general rule, also consider the possibility of rights for additional lines at this location.

"When investigating proposed construction near our pipelines the company's general rule can be stated with the comment that if the right-of-way provides for an additional line they will be advised; as this must be considered. To a person planning construction, this procedure will then serve as an informative warning regarding our require-

put them all together

they spell higher pumping efficiency even when worn



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ments and advise him of our position before construction starts.

"When requesting their cooperation you should explain why we need such working space and also some of the factors to be considered, such as grading, etc., when building near one of our pipelines.

"If these requirements are not acceptable to the owner, or builder, request that no construction be started until the necessary information, or decision, is received from the region office or, if necessary, the main office. When contacting the main office the region office should provide the following:

"1. All the general information that is available.

"2. Your recommendations, or suggestions, as to how this proposed construction should be adjusted or relocated to meet our requirements.

"3. A sketch showing the location of the proposed construction with respect to the pipelines.

"4. The possible location of an additional line if this is provided in the right-of-way.

"If an answer is required from this office in less time than can be expected from routine mail service, then telephone and give all possible essential information so that action can be taken immediately.

"In a number of cases we have released all of our right-of-way with the exception of the maintenance area. Should the land owner desire such a release we will be willing to prepare a Modification of Right-of-Way Agreement.

"Should you have any comments regarding the above or require any additional information, please advise."

Terminal handles largest tankers

Richfield Oil Co.'s supertanker terminal at Pier E in the port of Long Beach, Calif., is the only terminal in the United States that can handle supertankers at dockside. On opening day, the Princess Sophie unloaded 506,000 bbl. of crude oil at the terminal.

The terminal has a pierhead frontage of 1,255 ft., and water depth at dockside is 52 ft. at the lowest tide. This is ample depth for such vessels as the Princess Sophie which draws 44 ft.

The 19-acre facility cost Richfield $2,843,000. An additional $475,000 was spent on unloading units, pipelines to connect with company tankage, etc. In 1960, Richfield handled 45,000,000 bbl. of oil.

FPC approvals continue to rise

DURING the first 6 months of this year, the FPC issued construction certificates covering 1,051 miles of pipeline and 73,110 hp. in compressor capacity, having a total value of $181,483,192.

At the end of June, applications before the commission covered 6,487 miles of pipeline, 625,828 hp. in compressor capacity with a total value of $797,237,446. The June 30 totals in all categories was higher than as of January 1.

Here's the FPC record for the first 6 months of 1961:

Month	Miles of pipeline	Compressor hp.	Dollar value
January	7	2,400	$21,297,214
February	33	0	3,395,156
March	126	5,400	20,514,274
April	2	0	3,346,262
May	333	41,650	69,787,010
June	550	23,660	63,053,276

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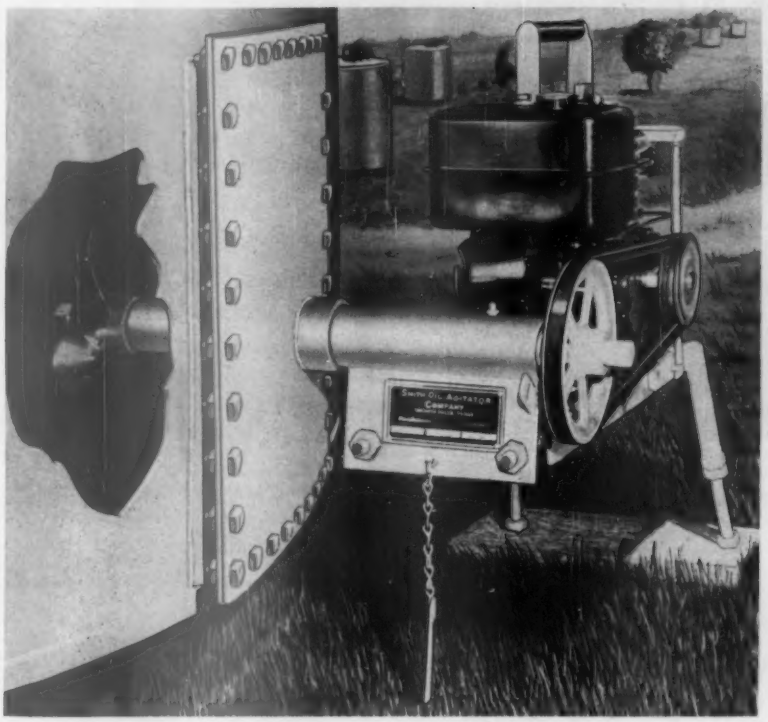
CHEMICALS DIVISION

What's NEW . . . in equipment



Agitator helps treat oil

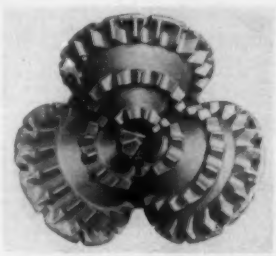
CHEMICALS can be readily blended with crude oil in storage tanks through the use of a new agitator. Easily attached to tanks, the unit has a three-blade propeller mounted on a 1-in. shaft 24 in. long. Its housing extends outside 9 in. from the manhole plate. An interlocking device on the housing locks the pulley wheel so the agitator cannot start while a tank is on line.

The agitator can be powered by an electric motor or an engine. One power unit can be used for several tanks. Source: **Smith Oil Agitator Co.,** 531 First - Wichita National Bank Bldg., Wichita Falls, Tex., U.S.A.

Two new rock bits

Both regular and jet types are available. The Model HW 3 bit has heavily hard-faced gage webs to give high resistance to gage wear. Compared with the Model H 3 bit, the HW 3 holds gage better in chert, chat, quartzite, pyrite, granite, dolomitic, and quartzitic sand rock, and other hard, abrasive formations where gage is a problem.

The Model H 3 will drill faster than the HW 3 in formations where gage is not a problem, the maker says. It has short, closely spaced teeth and large bearings to carry the



high loads required for crushing, chipping action to penetrate hard sandy limestone, chert, chat, granite, and similar formations. Source: **Globe Oil Tools Co.,** 11630 Burke, Los Nietos, Calif., U.S.A.

Clean, wrap 3 to 6-in. pipe

Twisted-wire wheel type of brushes revolving at high speed are used to mechanically clean pipe with a new pipe-cleaning and wrapping machine recently brought out for 3 to 6-in. pipe.

Only one head is used. But a counterrotating effect is used by rotation of the cleaning sprocket and an opposite rotation of the wire brushes. The machine is easy to adjust from one pipe size to another. Source: **Crose - Perrault Equipment Corp.,** 2765 Dawson Rd., Tulsa, Okla., U.S.A.

Want more facts about equipment or copies of product literature described in this issue?

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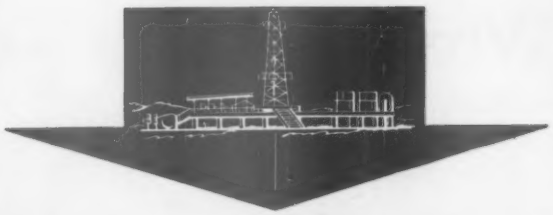

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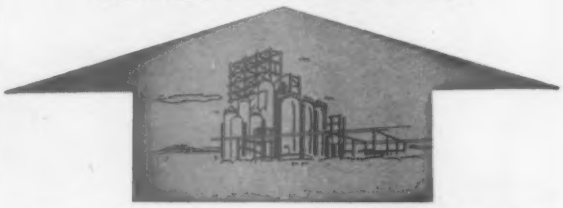

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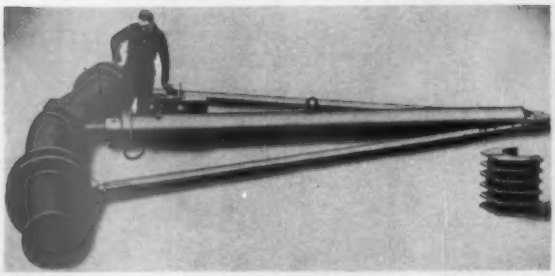
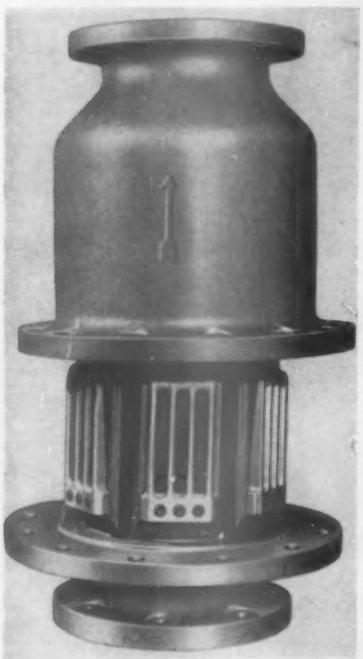


Bender for pipe to 18 in. o.d.

PIPE with wall thicknesses to ½ in. and diameters to 18 in. can be bent with a recently designed field bender. The machine is portable and operated with hydraulic power.

An air-hydraulic pump which can be powered by a small compressor or air line operates the ram of the Staffa bender. So the machine will be easy to transport, the designer has fitted the pipe clamps to two pivoting arms. Thus the pipe to be bent forms a part of the machine's structure. Source: **Chamberlain Industries Ltd.,** 3, Buckingham Palace Gardens, London, S.W. 1, England.

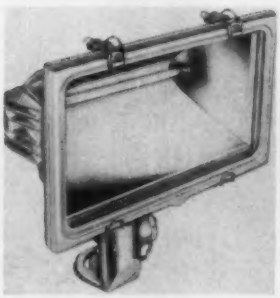


Check valve for high flow rates

Protection from system surge, back flow, and other problems is offered by a new check valve for gas pipelines, refineries, and petrochemical plants. Rapid, quiet response with efficient straight-through flow and low pressure drop are among the features claimed for the valve. Stainless-steel leaves retained by keepers control back flow.

To avoid the possibility of chemical reactions between gases and seals, metal-to-metal contact is used. The valve can be mounted horizontally, vertically, or at any angle in a pipe or compressor discharge line.

Available for pressures to 1,000 psi., the valve can be obtained with a cast-iron, cast steel, or alloy-steel body in pipe sizes from 6 to 48 in. Source: **Clark Bros. Co.,** Olean, N. Y., U.S.A.

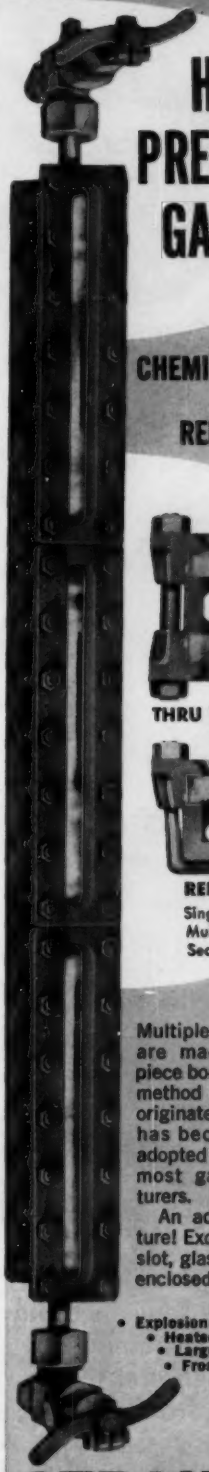


Floodlight gives bright light

A 1,500-watt quartz-iodine lamp in this new Quartzlite 1500 floodlight gives 22 lumens per watt throughout a 2,000-hour life, the maker claims. The reflector design is said to provide an unusually efficient beam pattern—wide horizontal distribution with sharp vertical cutoff to prevent excessive spill light.

Dimensions are 14⅜ by 9 by 6⅞ in. deep. Weight: 19 lb., including a pole fitter. Source: **Appleton Electric Co.,** 1701 Wellington Ave., Chicago 13, Ill., U.S.A.

Strahman



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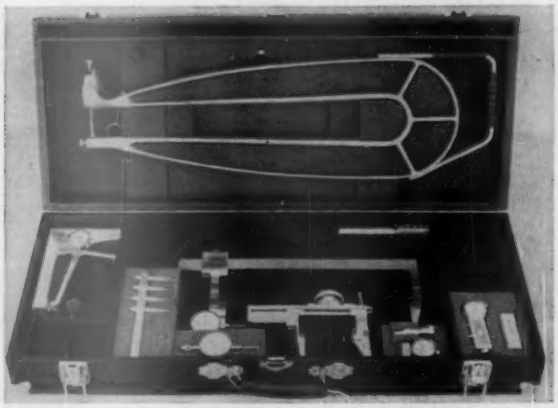
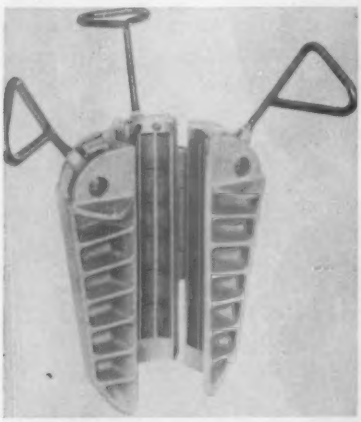


Precision gage for tubing, casing

PIPE, CASING, or tubing can be accurately measured with a new line of pipe gages just put on the market.

Designed for field or plant use, the gages are offered individually or in a set. They are made and designed to maintain their accuracy for years of field use. Standard equipment includes a dial indicator. Source: **Kuster Co.,** Box 7038, Long Beach 7, Calif., U.S.A.



Strong rotary slips

Newly engineered buttress structures enable each of the slip sections on a new line of rotary slips to withstand high axial and transverse loads, the maker says. The slips come in types to handle all hook loads.

The Type SDS-Short is designed for loads up to 180,000 lb.; Type SDL - Long is designed for loads over 300,000 lb.

Features include case - hardened inserts designed with considerable line contact to give necessary gripping without scarring the pipe. The inserts can be quickly replaced with circular buttons for rotating the drill pipe. Source: **Abegg & Reinhold Co.,** 2533 E. 26th, Los Angeles 58, Calif., U.S.A.

Latest heat-exchanger tube design

A single piece of aluminum provides a combination of parallel tubes and strip material with this design, called Tube-in-Strip. The tubes form an integral part of the strip. No brazing, welding, or other bonding is used in its manufacture.

The tubing with the extended outer surface is considered particularly suited for heat-transfer applications between fluids of different heat-transfer characteristics, such as liquid and gas. Source: **Imperial Aluminum Co., Ltd.,** P. O. Box 216, Witton, Birmingham 6, England.

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Oil emulsion treater

A new treater has been announced that's designed as a cold-weather treater without internal piping. The piping and controls are centralized in a heated enclosure, accessible through two doors.

The controls and piping are factory-assembled. Four field connections are required. The Model HT-21 treater uses a horizontal flow pattern. It operates as a pressure

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3
Center plates between each sheave strengthen entire structure and eliminates center pin deflection.
4
Bearings sealed against foreign matter, retaining grease in bearing cavities.
5
Simplified locking mechanism — only three parts.
6
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treater, with or without gas, and automatically changes from gas to hydraulic delivery without manual attention. Source: **Sauder Tank Co., Inc.**, Emporia, Kans., U.S.A.

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Machine removes dust fast

The strong suction achieved by this new dust-removal plant enables it to remove 1,600 lb. of dust an hour using a 20-hp. motor. The unit illustrated is mounted on a 3-ton trailer. Those for use in petroleum plants are flameproof.

A companion unit, the Model FDP, has been designed to remove flue dust, either hot or cold, from boiler flues, at rates to 6,000 lb. an hour, with two operators. Its storage capacity is 10 cu. ft. Source: **Bivac Air Co. Ltd.**, Portwood, Stockport, England.

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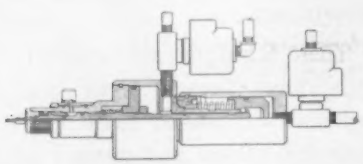

New pilot for remote spots

The electrically controlled pilot, called an Electro Pilot, is expected to be valuable where electrical power is not readily available, except from batteries. The three-way solenoid valves on the pilot are not energized continuously, but only for the 2 or 3 seconds required to operate the pilot.

Designed for installation on the maker's surface safety valves, the pilot can be used to open or close the safety valves on remote locations or lease-automation installations. Remote control may be by telephone, microwave, or radio. Source: **Otis Engineering Corp.**, Box 35206, Dallas 35, Tex., U.S.A.

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Water-soluble foaming agent

The product comes in liquid form with corrosion-inhibiting properties for use in gas wells, water-injection wells, and salt-water disposal systems. Tradenamed A-20-F, it's claimed to combine low cost and easy handling and to protect surface equipment against corrosion damage.

As described by the maker, the product forms a foam column that can be lifted from a gas well by gas pressure which normally may be too low to lift a column of water. It can be fed by pump or in batches. Source: **Visco Products Co.**, P. O. Box 87, Houston, Tex., U.S.A.

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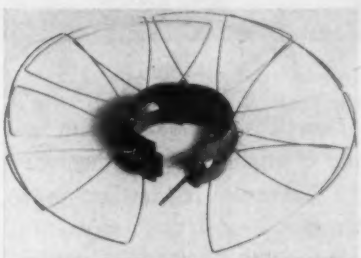

Reciprocating wall cleaner

One of the latest developments for single-string tubing completions is this RWC wall cleaner for 2⅞-in. o.d. tubing completions. It is an abrading device for removal of filter cake.

Specifications include a 3.65-in. o.d. body of 14-gage steel, with integral spot-welded hinges to make the cleaner easy to install. Tempered, 0.072-in. piano wire is formed into semicircular abrading springs. These are overlapped and positioned around the body to give the cleaning action.

The cleaner is placed around the tubing with the overlapping abrading springs pointing up so they fold inward as the tubing is lowered. It measures 12 in. in diameter across the abrading springs for use in 6¾ to 9⅞-in. hole sizes. Source: **Halliburton Co.**, Duncan, Okla., U.S.A.

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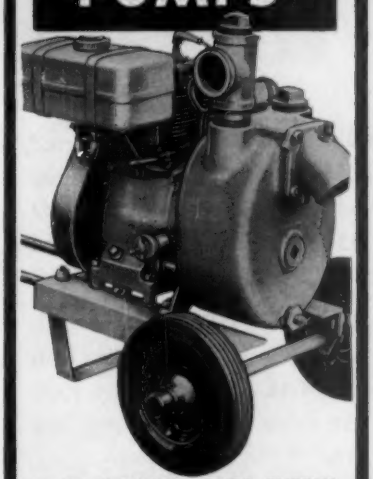

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The one difference that towered above all others is engineering. Dowell designed each treatment to fit well conditions and the operator's needs. The result was extra profit.

Dowell is well-qualified in the kind of engineered treatment design that results in excellent profit increases.

Dowell developed the Acid Guide* — a new method for designing treatments and predicting probable results. Several thousand successful acid jobs have been designed with the help of the Acid Guide within the past two years.

Dowell has an unsurpassed fund of data on formation and fluid characteristics from many fields. This information is necessary for scientific treatment planning but it is often not available from individual operators.

Dowell has a large variety of acid additives as well as collateral products and services to improve results from acid treatments.

To summarize, Dowell has the experience, the information, the acid additives, the collateral products and services, the technically-trained personnel and the laboratory facilities to design engineered acid treatments. Results have been high success ratios and satisfactory payouts on investments.

There *is* a difference in acidizing services. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

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What's NEW

. . . in literature

On-stream descaling

A new, quick-reading description of the latest materials and methods now in use for on-stream descaling of heat-exchange equipment has just been released. Service Bulletin 29B contains a diagram which illustrates a typical on-stream descaling procedure and detailed product descriptions of successful materials now being used for this operation. The two-page bulletin includes general information about descaling of water-cooled equipment used in petroleum, petrochemical, and chemical-processing operations. Source: **Oakite Products, Inc.,** 1440 Rector St., New York 6, N. Y., U.S.A.

Centrifugal pumps

Complete installation, operation, maintenance, and servicing of centrifugal pumps are covered in new 18-page, illustrated Bulletin G-2971. Information includes storage, foundation construction, alignment, and piping; priming and starting, lubrication, trouble-shooting, and basic servicing; and internal inspection. Source: **Worthington Corp.,** 426 Worthington Ave., Harrison, N. J., U.S.A.

Deep-drilling rotary

The new 27½-in. Type B-275 rotary for deep drilling is spotlighted in new Bulletin 525, just issued. In eight pages it describes the rotary's design and construction features, including rectangular housing, matched and lapped spiral-bevel pinion and gear, unitized gear-table assembly, and cartridge pinion-shaft assembly. Source: **National Supply Div., Armco Steel Corp.,** Two Gateway Center, Pittsburgh 22, Pa., U.S.A.

Sonic oil-well pump

This 14-page brochure provides a detailed engineering description and evaluation of the pump. In addition to 12 illustrations, the report includes the sonic pump's: (1) components and functions; (2) theory of operation; (3) design specifications; (4) installation procedure and layout; and (5) performance. Engineering Report 6-61 presents an evaluation of sonic-pump operational mechanics as applied to normal and problem wells (sand, mud, paraffin, gypsum, corrosion, gas, volume). Case histories are incorporated to illustrate actual field performance under severe well conditions. Source: **Johnston Testers, Inc.,** Box 98, Houston 1, Tex., U.S.A.

Water-distillation plant

Featured in this 12-page brochure is the Thermoflash water-distillation plant, with outputs ranging from 25,000 to 5,000,000 gal. per day. The literature piece offers photographs of the units, along with benefits, operational data, physical data, and features. Source: **Bennis Thermoflash, Ltd.,** Little Hulton, Walkden, Manchester, England.

Pipeline valves

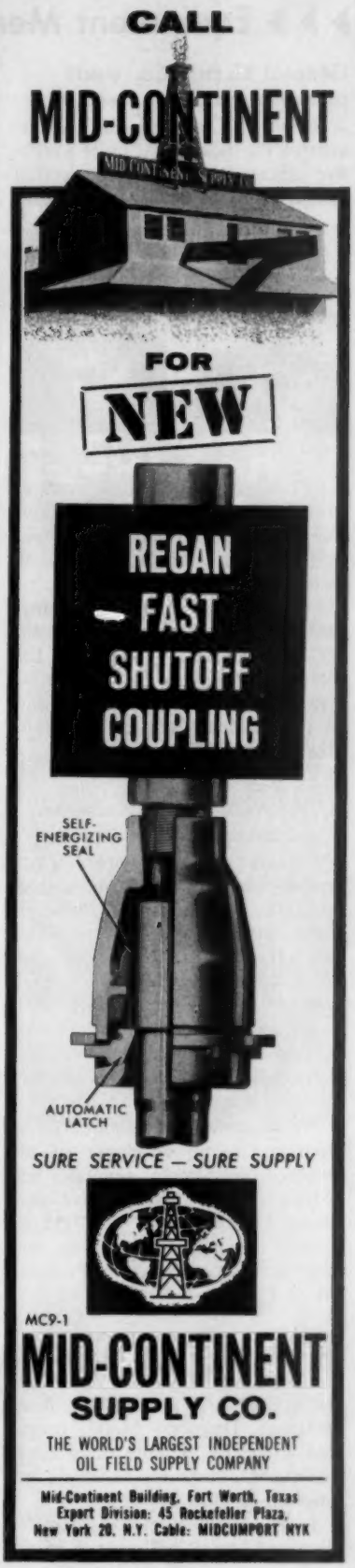
Bulletin G-543A (18 pages) provides a concentrated report on exclusive features of the maker's G-3 cast-steel pipeline gate valves, G-4 high-pressure fabricated pipeline gate valves, G-5 general pipeline and manifolding-service valves, and G-6 regular port valves. Also available by request is new technical Bulletin G-561, dealing with Valv-Pak, a compact wellhead-valve assembly. Source: **Grove Valve & Regulator Co.,** 6529 Hollis St., Oakland 8, Calif., U.S.A.

Storage tanks

Illustrated and described in this four-page publication are: (1) domestic storage tanks, from 150 to 750-gal. capacity; (2) rectangular storage tanks, with capacities from 600 to 30,000 gal.; and (3) cylindrical storage tanks, with 250 to 30,000-gal. capacities. The literature gives information on applications, specifications, and delivery. Source: **Roberts Bros.,** Junction Rd., Wordsley, England.

Pumps Bulletin P5

In a 20-page form, this publication presents various pumps for self-priming jobs, for hot and cold process duties, compact installations, vacuum extraction, and for general and corrosive-chemical services. Featured are pumps with corrosion-resistant linings and others designed for mobility. Tables and graphs are included. Source: **British LaBour Pump Co., Ltd.,** Blundell St., London N. 7, England.



▶▶▶ Equipment Men Notes

General Electric Co. elects president, executive veep

Ralph J. Cordiner, GE's chairman of the board and chief executive officer, announced the election by the board of directors of Gerald

G. L. Phillippe

C. W. LaPierre

L. Phillippe as president and of Cramer W. LaPierre as executive vice president of General Electric. Both men also were elected directors.

Phillippe, 51, had been comptroller and principal financial officer of the company since 1953. LaPierre, 57, formerly was vice president and group executive in charge of the company's Electronic and Flight Systems Group.

H. H. Welker joins Texsteam Corp. as sales supervisor

. . . for gas-control equipment, it was announced by W. B. Colvin, sales manager of Texsteam's Pump & Valve Division. Welker was formerly southern district sales manager for Accessory Products Co., a division of Textron, Inc. When Texsteam acquired Apco's line of gas-pressure-reducing regulators and dump valves, Welker was retained by Texsteam.

Welker, who will headquarter in Houston, is the developer of the patented "Jet Stream" regulator and "Check Stream" dump valve purchased by Texsteam. In 1955 he formed his own firm, which was purchased by Accessory Products Co. in 1958.

Reed Roller Bit Co. purchases

. . . Diamond Metal Co., of Houston, according to John Maher, Reed president. Diamond Metal, organized in 1932, manufactures tungsten-carbide-surfacing materials and tungsten-carbide castings.

J. R. Henderson, president of Diamond Metal, will remain in the top managerial post at Diamond, which will now operate as a division of Reed. Henry M. Johnson, vice president and co-owner and the firm's sales manager, will continue to manage sales for the new division.

Crane purchases Deming Co.

Addition of Deming's manufacturing facilities in Salem, Ohio; Rogers, Ark.; and Monterrey, Mexico will permit Crane Co. to enter the industrial pump business for the first time in the United States and Mexico, according to D. C. Fabiani, Crane's executive vice president. Walter F. Deming, who represented the fourth generation of family management as president of Deming, will continue his association with the company as general manager of the new Crane division.

Continental-Emsco Co. names

. . . W. E. Lasseter as division merchandise manager of the company's Oklahoma-Kansas division. He will headquarter in Oklahoma City. Lasseter is the former manager of CE's branch store in Oklahoma City, an assignment he has held since 1959. He first joined the company in 1953 as division material man in Oklahoma City, and has also served as manager of Continental-Emsco's store in Houma, La.

Heart of Texas Mining Corp. transfers general offices

. . . from Hurst, Tex. to Dallas at 2510 Fidelity Union Tower, according to W. O. Ferguson, chairman of the board. Ferguson also announced that Henry F. McCabe has been elected vice president and general manager. The corporation is engaged primarily in the mining, processing, and marketing of fracturing sand for the oil and gas industry.

William C. Krutzsch, Jr. named

. . . manager of engineering for Worthington Corp.'s Harrison (N. J.) Division. The division manufactures centrifugal compressors, condensers, deaerators, boiler feed pumps, and large centrifugal pumps. Krutzsch joined Worthington in 1948 as a design engineer. He later served as assistant chief engineer—horizontal pumps, and chief engineer, centrifugal-pump engineering.

Worthington also announced the appointment of C. W. Lauman Co., Inc., Bethpage, N. Y., as a new distributor of vertical turbine pumps. Lauman's territory will include six counties in New York State.

Atlas Powder Co. changes name

. . . to Atlas Chemical Industries, Inc., according to Ralph K. Gottshall, president of the Houston concern. Chief reason for the change, Gottshall reported, was that through the years the company has become increasingly a manufacturer of chemicals.

DYNEL, INC., specialist in the development and manufacture of pulse-code telemetry and control systems, recently doubled its facilities by moving into this new 18,000-sq.-ft. building in Los Angeles. This is one of the initial expansion moves planned by the parent company, Varec, Inc., according to Ray V. Long, president. Concentrating on electro-mechanical control for the petroleum, chemical, and petrochemical fields, Dynel is now equipped to serve as a single source of supply for design, fabrication, and installation of remote monitoring and control systems for tanks and pipelines.

Kenneth S. Adamson takes over

K. S. Adamson

. . . as application engineer, specializing in regulators, for Grove Valve & Regulator Co., it was announced by George E. Doty, vice president and general sales manager. Adamson will be headquartered in Grove's Los Angeles sales office, but his territory includes the entire United States. Prior to joining Grove, Adamson was manager of sales engineering for Pre-Flite Division of Avco Corp., and sales engineer for Electro-Dynamic Division of General Dynamics.

Borg & Beck Div., Borg-Warner makes pair of appointments

A. A. Krueger is the new vice president of sales, and R. L. Smirl takes over as vice president of engineering, according to Harold Nutt, president and general manager of the division. Borg & Beck makes clutches and torque converters for trucks and tractors.

Krueger, who has been associated with Borg & Beck for 40 years, was formerly sales manager and assistant to the general manager. Smirl has been with the division 25 years, beginning as a project engineer. Most recently he served as director of engineering.

New cementing stations opened by Dowell Div. of Dow Chemical

. . . at Lafayette, La. and McComb, Miss. to serve oil and gas-well operators in those areas, announces J. B. Stewart, manager of Dowell's Louisiana-Mississippi Gulf Coast district. The installations provide complete storage of bulk cement and admixes as well as blending, weighing, and metering facilities for loading of cement transports.

Tuboscope assigns T. G. Bogle

. . . as sales coordinator for its northwest region. He will coordinate company sales activities in the western states and Canada, which are under the management of A. B. Roop. Bogle, who will headquarter in Odessa, previously served as test engineer for Convair Division of General Dynamics Corp. for 5 years. Later he was head of Tempco Air Corp.'s experimental laboratories.

B-I-F Industries made division of New York Air Brake Co.

B-I-F will continue to locate in Providence, R. I., under the same operating management and with no change in aims or objectives. B-I-F is involved in automatic flow control, measurement, and weighing of gases, liquids, and solids. The firm also provides equipment and engineered systems for many process industries.

Herbert D. Bissell is appointed

. . . sales manager of Century Electronics & Instruments, Inc., Tulsa, in which post he will direct the marketing of Century's recording instruments, pressure switches, and telemetry equipment. Bissell has had more than 20 years experience in aircraft and related industries. Before joining Century he was senior sales engineer with the Garden City, L.I. office of Garrett Corp.

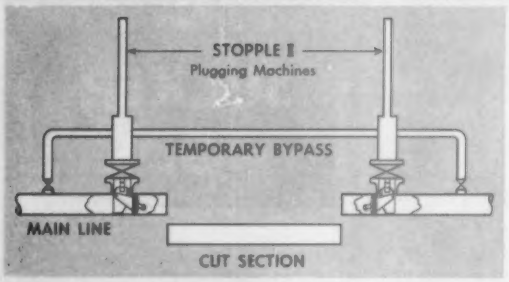
Arnell Co. acquires control

. . . of Eastman Oil Well Survey Co., of Denver. Eastman is active in specialized oil-well drilling throughout the Free World. Arthur C. Allyn, who recently purchased control of the Chicago White Sox baseball team, is president of Arnell.

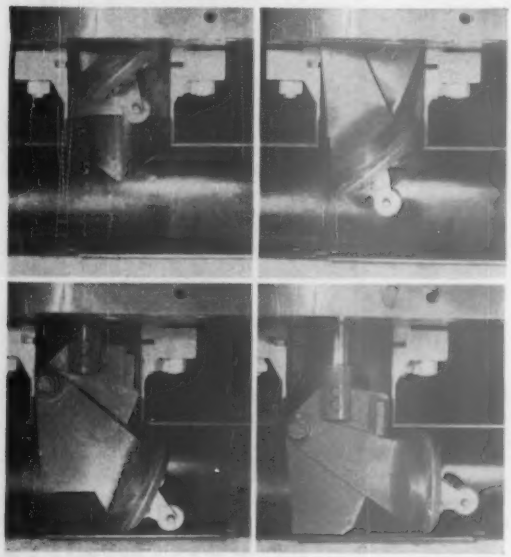
Announcement of the purchase was made by Philip D. Arterburn, president of Eastman, and Allyn, who traveled to Denver for the formal signing. Founded in 1932, Eastman produces directional-drilling equipment. The company has subsidiaries in Hanover, Germany; Calgary, Alta.; and Maracaibo, Venezuela.

Brooks Instrument Co., Inc. buys Francisco Engineering Co.

. . . a California manufacturer of turbine-type and mass flowmeters, along with associated electronic digital-transmission and computer-control equipment. Brooks makes rotameter-type flowmeters, as well as level-control instruments. Fran-



❶ "This method of plugging a line and bypassing the flow has been used extensively in plant and field operations with WMSon tapping and STOPPLE equipment. Many costly shutdowns have been avoided. Now, WMSon engineers have re-designed and improved the STOPPLE Plugging Machine. Result . . . the all new STOPPLE II . . . offering hydraulic operation, improved, simplified construction, and economy—**real** economy!"



❸ "Here's how STOPPLE II works. After the tap is made, the STOPPLE II is mounted on a WMSon SANDWICH Tapping Valve, and the plugging head is lowered into the line, stopping the flow completely. New single link construction of the plugging head offers built-in simplicity . . . and strength for high pressure plugging."

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WMSon STOPPLE II with hydraulic operation is available in sizes 8"—30". The 4" and 6" units are hand operated. Single link is standard in all sizes. Write for additional information and specifications: *Write Dept. A for Bulletin A-513.*

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REPRESENTATIVES AROUND THE WORLD

cisco Engineering will supplement the company's electronic-instrumentation capabilities in the advanced areas of flow control, such as digital transmission and inline blending.

Francisco Engineering will be operated as a separate entity under the name of Hydropoise, Inc., a subsidiary of Brooks. Its headquarters and plant have been moved to Scottsdale, Ariz. Edward Francisco, Jr. will continue as president and general manager.

Empire Rubber Co.'s new plant will serve petroleum industry

... by supplying custom-molded-rubber components for original-equipment manufacturers. President of the new firm is Tom Waldrop,

Tom Waldrop

John Ekey

who has been associated with the oil-field-rubber business more than 11 years. Sales manager is John Ekey, a veteran of 10 years in oil-field sales and engineering.

The new Empire plant is located at Grapevine, Tex., in the Dallas-Fort Worth area. Facilities include over 10,000-sq.-ft. of production and storage space, housing equipment for milling, extruding, and molding both synthetic and natural rubber. Waldrop noted that in the near future his company plans to supply the petroleum industry with a variety of expendable rubber products, including swabs, oil-saver rubbers, packer rubbers, and similar items.

Tinker & Rasor Co. purchases

... Detectron Co. from Computer Measurements Corp., Sylmar, Calif. Manufacturing operations are now under way in the Tinker & Rasor plant at San Gabriel, Calif. The Detectron line of pipe locators is expected to complement Tinker & Rasor's precision equipment for detecting flaws in protective coatings, since now it will be possible to obtain both holiday detectors and instruments for detecting, tracing, or testing underground pipelines from the same source.

Roger E. Porter joins Totco's sales and service organization

... in Odessa, Tex., it was announced by John Davis, general sales manager of Technical Oil Tool Corp. Porter will work out of Odessa under the direction of Hugh Weathersby, division manager.

Magnet Cove Barium Corp. promotes Robert W. Ruhe, Jr.

... from staff service engineer to chief service engineer at Houston, it was announced by I. W. Hoskins, senior vice president of marketing. Ruhe succeeds James N. McCaskill who resigned. Associated with Magcobar since 1952, Ruhe has served as a sales and service engineer on the Texas Gulf Coast, as a laboratory instructor of engineering training, and as a staff service engineer.

Claude R. Whelchell joins Security Engineering Division

... as a special sales representative for the Gulf Coast division, it was announced by K. L. Byerly, vice president for domestic sales. Whelchell has been associated with the oil industry in various sales positions since 1937. He will locate at Security's new Gulf Coast division headquarters in Houston.

Houdy Process Corp., Italian firm establish new company

... in Cassino, Italy to manufacture and sell polyurethane foam and foam products. The new firm—Montecassino, S.p.A.—will be equally owned by Houdry Process, of Philadelphia, and Compagnia Internazionale Generale Industriale—Malatesta, S.p.A., (CIGI). Manufacturing operations in the Southern Italy city are expected to be under way late this year.

The establishment of the Italian firm is the second European joint venture effected by Houdry in the past 10 months. Last September, Houdry and Chemische Werke Huels, of Marl, West Germany, formed Katalysatorenwerke Houdry-Huels G.m.b.H., (KWH) to manufacture and sell catalysts.

Initially, Montecassino will market its foam and foam products in Southern Italy and the Mediterranean basin area. Both rigid and non-rigid polyurethane foam will be manufactured.

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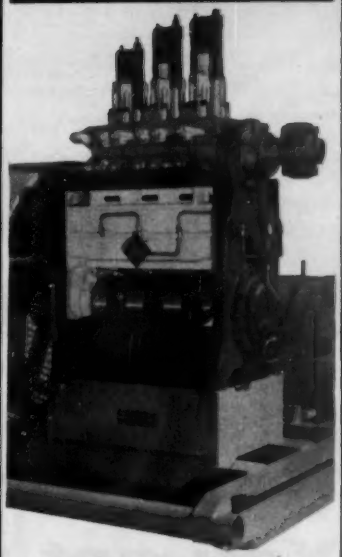

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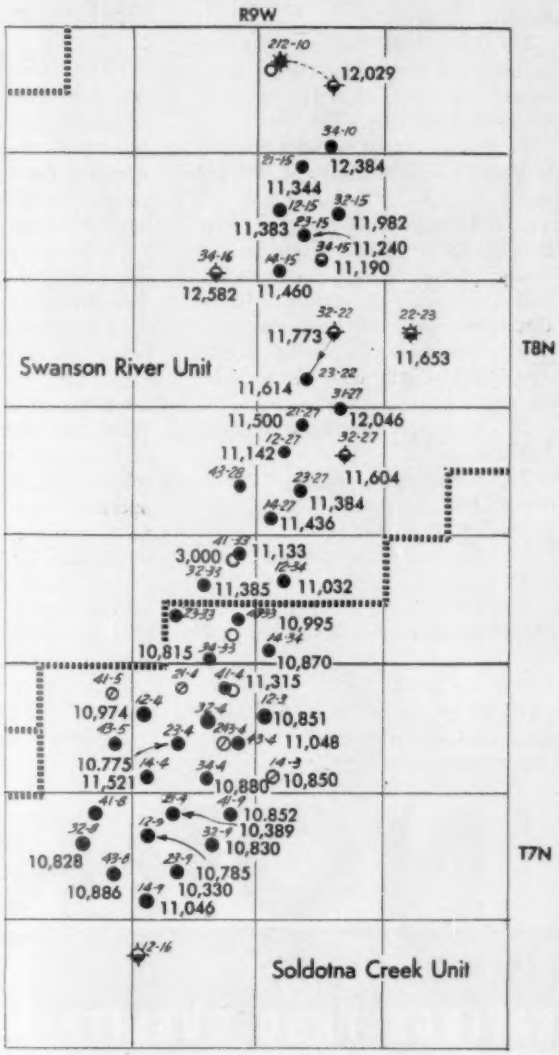

DATA ON ACTIVE FIELDS

Swanson River field, Kenai Peninsula, Alaska

1. Approved field name: Swanson River field, comprised of Swanson River unit and Soldotna Creek unit. Location: Western edge of Kenai Peninsula in South Alaska.

2. Discovery well: Swanson River—Standard Oil Co. of California-Richfield Oil Corp. Swanson River unit 34-10 SW SW 10-8n-9w, IPF 900 BOPD, discovered September 29, 1959. Soldotna—Standard Oil of California and Richfield Soldotna Creek unit 41-4 NE NE 4-7n-9w, IPF 3,400 BOPD, 38.6° oil through 32/64-in. choke, discovered March 21, 1960.

3. Trend of development: North-south.

4. Number of producing wells: 39.

5. Spacing pattern: 80 acres.

6. Proved acreage: Approx. 4,000 acres.

7. Principal operators: Standard Oil Co. of California.

8. Present allowable: None, limited only to 8-in. pipeline capacity (proposed 30,000 bbl. daily).

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Drilling Operations

9. Number of active drilling rigs: 6.

10. Casing program: 13⅜-in. surface pipe set at 3,000 ft. w/2,000 sacks cement. 7-in. oil string set at 12,000 ft. (TD) w/600 sacks cement.

11. Average drilling time per well: 31-36 days (recent wells).

12. Types of drilling fluid: Emulsifiers, 95 lb. per cu. ft.

13. Completion method: Perforate casing.

14. Number of bits: 60.

15. Special problems: Some wells are directionally drilled. Note: On map above, open circles are surface locations and dotted line to well shows direction of drift to bottom-hole location of well.

Geology

16. Producing formation: Lower Tertiary Hemlock-Eocene sand at 11,000-12,500 ft.

17. Reservoir characteristics: Type drive: water drive. Gas-oil ratio: varies from 116:1 to 400:1.

18. Geologic markers: Entire stratigraphic sequence, names and depths, not available, but surface beds are undifferentiated glacial and glaciofluvial deposits.

19. Type trap: Narrow anticline cut by numerous transverse faults. This explains need for directional drilling.

20. Core data: In discovery well at Swanson River, the SRU 34-10 found its pay formation from 10,150-11,700 ft. Thicknesses of pay varies from 8,300-ft. Porosity is 15-25%. Permeability is 0-3,275 md.

21. Accumulative production: Reportedly, Swanson River is currently producing approx. one-half million barrels a month. As of December 31, 1960, cumulative production was: 45,213 bbl. water, 780,343 bbl. oil, and 148.6 M.M. c.f. gas.

22. Reservoir pressures: 5,500-5,800 psig.

23. Tests and logging procedures: I-ES, Sonic, Microlog, and Dipmeter are run in wells.

24. Pipeline outlet: Kenai Pipeline.

25. Exploration methods before discovery: Seismic and surface geology.

26. Average costs: Dry hole $450.00. Flowing well $550,000 Average total depth 11,200 ft. Day rate with pipe is $1,900.

27. Crude analysis: 31°-38.6° API gravity.

Drilling crews exempt from fire fighting

ACCORDING to a recent policy statement on conscription of drilling crews for fighting forest fires in Alberta, the Oil and Gas Conservation Board has expressed the following ruling:

"Effective immediately, one crew consisting of a minimum of five men, will not be conscripted for fire-fighting duty on any well drilling below the surface casing shoe, provided that complete evacuation is not required in the interest of safety. When an emergency condition occurs at any well requiring action beyond the ability of one crew, the operator's request for release of any or all other employes will be given immediate consideration and approval when the Alberta Forest Service is advised by the Oil and Gas Conservation Board that an emergency exists."

In addition to the above policy, the new "Forests Act, 1961," effective immediately, exempts battery operators from fire-fighting duties.

W. C. NORRIS

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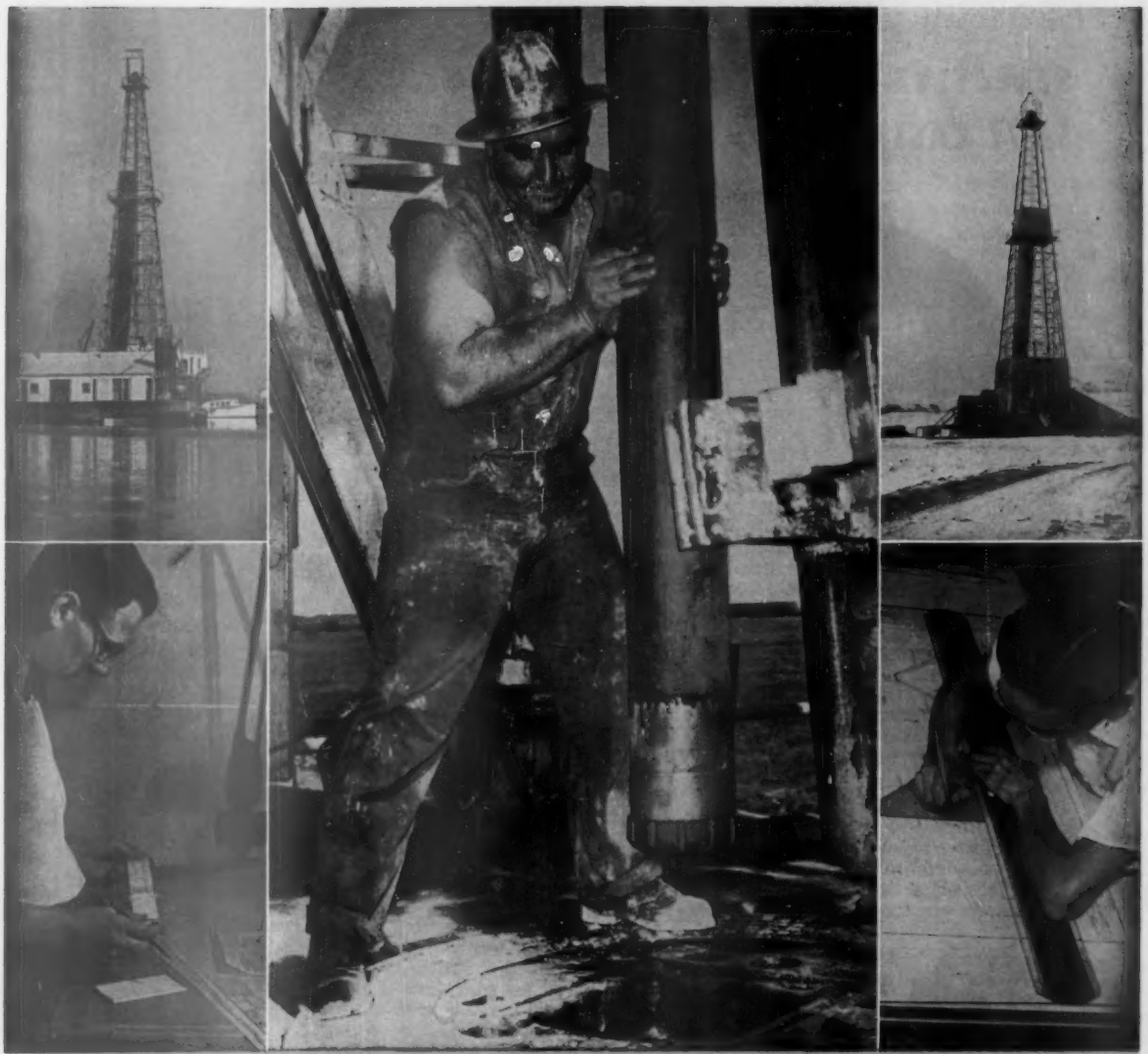

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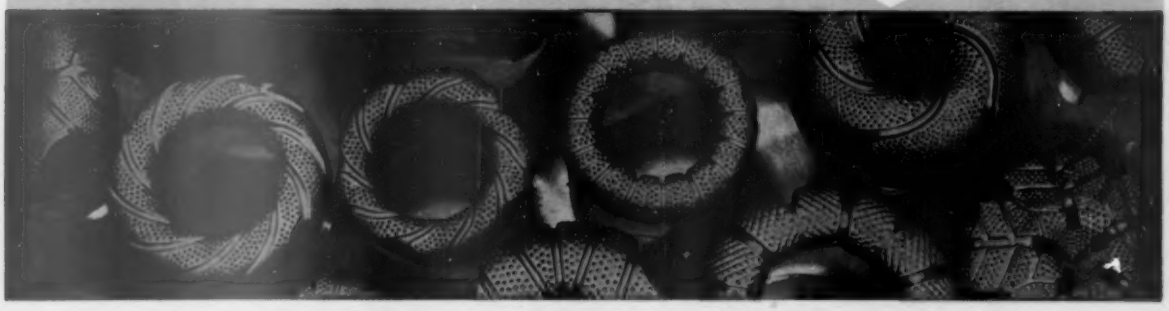

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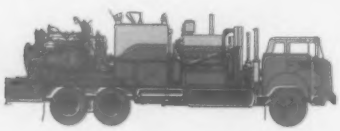

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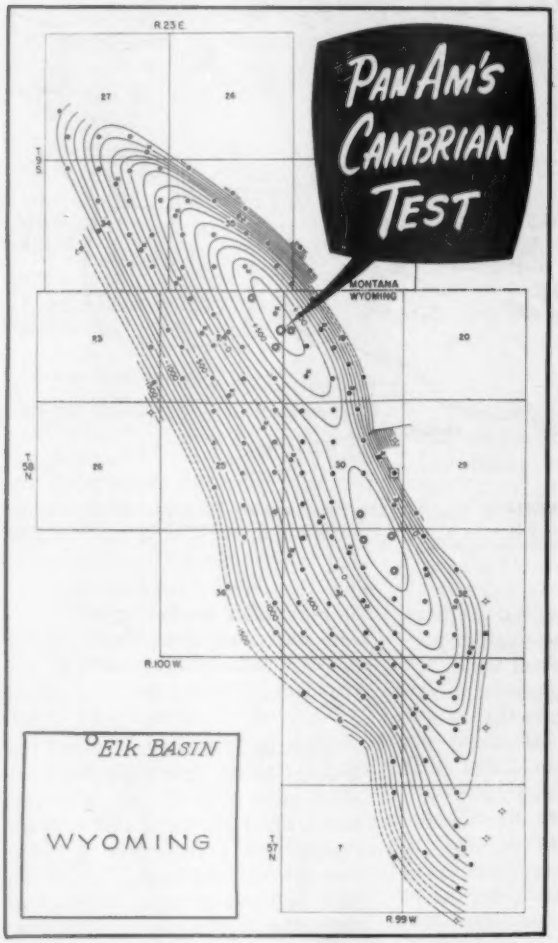


A DEEP TEST on the crest of the Elk basin anticline in northern Wyoming has found the first Devonian oil ever uncovered in the Big Horn basin, and the second Ordovician reservoir. The structure, here contoured on the top of the Tensleep formation, first produced oil in 1915.

Old oil fields never die

• After 46 years of production, a Wyoming graybeard shows bright new possibilities for the future

BY FRANK J. GARDNER

A RECENT LETTER in our "They Say" column (OGJ, July 3, p. 64) posed this question: "Why are there seemingly constant upward revisions in reserve estimates for the large fields?"

The answer is easy. Old oil fields (or at least the giant ones) just never seem to die. Some may appear to be coughing up the last drop, but it's hard to think of a single giant field that has been completely abandoned. Look at Bradford. Spindletop. Burkburnett. Or Elk Basin.

Oh yes, Elk Basin. Discovered in 1915. Cumulative production 185 million barrels. Still pouring out 20 million a year.

Is it dead? Far from it. Look at the map. At the arrow, a deep exploratory test, a "new-pool wildcat" the AAPG would call it, is going down. Objective: Cambrian. And already it has added two important new reservoirs to the 46-year-old field.

Important firsts . . . Pan American Petroleum Corp.'s 189 Unit, in Section 19-58n-99w, near the Wyoming-Montana state line in Park County, Wyoming, is the well in question. It's the first well in the field to penetrate the complete Devonian section. It's the first to penetrate the Ordovician. And it's found oil in both.

Four drill-stem tests in the Jefferson-Devonian section between 5,288 and 5,546 ft. had commercial shows of oil. A fifth, in the Big Horn-Ordovician at 5,683-5,741 ft., also yielded good oil recoveries. A sixth and seventh, also in Ordovician at 5,961-6,065 ft., had the same result. Pan Am now is drilling on down toward the Cambrian objective, and if that formation should also produce, Elk Basin will have written the exploration story of the year in Wyoming.

This is the first Devonian oil in the entire Big Horn basin, and the second in the Ordovician. Hamilton dome is the only Ordovician field at present. There is only one Cambrian field in the basin now, and that's Oregon Basin.

The two new pays are the sixth and seventh for Elk Basin field. Frontier-Upper Cretaceous oil was found in 1915, Dakota-Lower Cretaceous gas in 1922, Phosphoria-Permian and Tensleep-Pennsylvanian in 1942, and Madison-Mississippian in 1946.

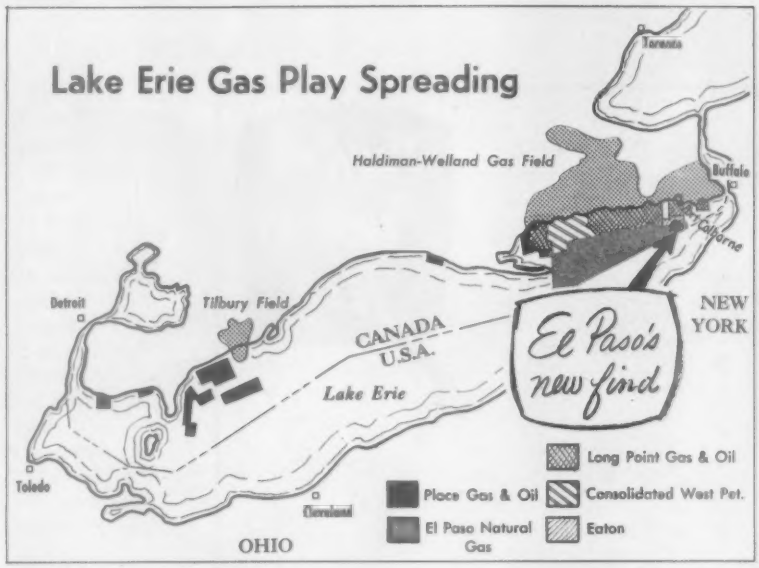
There have been Devonian tests in the field earlier, but none was commercial. Pan Am itself (as Stanolind) had drilled a Devonian failure only ¼ mile northeast of the new discovery; that test, the 40M Unit, ran 782 ft. lower on the Devonian top than the 189 Unit.

Provide the answer . . . What Pan Am intends to do about final completion of this important deep test is not yet known. It could make a dual, a triple, or even a septuple completion, presumably. In any case, this is the most vivid answer we can imagine to a Journal reader's question. Reserve estimates at Elk Basin are in for a major revision . . . **upward.**

Lake Erie—major offshore gas prize grows

THIS YEAR'S first discovery was found in the form of commercial gas in a well 5½ miles offshore by El Paso Natural Gas Co. The gas find lies in Lake Erie waters at a point 12 miles southwest of Port Colborne, Ont., at the east end of the lake.

Unusual platform. The company is using the most unusual drilling platform seen to date on the lake, a 3,000-ton former grain ship—the S.S. Simcoe—converted to a drilling barge. The propeller has been removed and an 86-ft. derrick fitted in the ship. Drilling is done from the center of the vessel through a 15-ft. slot. The ship is equipped with cranes, air compressors, and other drilling equipment. It can drill in depths up to 200 ft. The first well has been brought in in 55 ft. of water. The vessel is based at Port Colborne and is towed to its different drilling locations.



THIS SUMMER'S GAS-HUNTING on Lake Erie has reached its peak. Before the ice comes back to the Great Lakes, at least 40 wells will be completed. Map above shows who's drilling and where.

Huge spread. El Paso has a huge acreage spread in the east end of Lake Erie and plans to drill 10 to 12 more wells this season.

Three other companies have active drilling programs on the lake this season, a fourth company has plans to drill two wells. In all, 38 to 40 wells are expected to be drilled this season.

One hundred and fifty gassers. There are now some 150 gas wells in Lake Erie that are producing or capable of producing. Their locations range from ½ mile offshore to 8½ miles and stretch from a point off the Tilbury gas field in the western end of the lake, eastward to Port Colborne.

So far, all the wells brought in have been underwater extensions of long-established onshore gas fields. Most of the wells are modest by western Canadian standards, the open-flow potential averaging a little over 500 M.c.f.d. But last year several wells were brought in that raised the stature of the whole offshore play substantially. One had an initial open flow of 5.5 M.M.c.f.d. Two others were almost as large.

From the Financial Post, July 22, 1961, Toronto.

The Lake Erie wells don't have to be as large as the western producers to be commercial since they command a starting gas price in Ontario about three times that of the western producers—35 cents per M.c.f. The shallower Lake Erie wells are also considerably less costly to drill—$25,000 to $35,000 each, compared with $50,000 to $750,000 in the west. Virtually all the gas production is being sold to one company under long-term contract—Union Gas Co. of Canada. Total revenue is estimated to be running around $1.3 million a year.

The Big Four

Consolidated West Petroleum. This is by far the biggest offshore gas company. The company has some 70 commercial wells in the lake ranging from ½ mile to 8½ miles offshore. Gross income from sales in 1960 was $903,955. Gas is being sold to Union under long-term contract. Prices range from 35 to 40 cents per M.c.f. Company's holdings are in western end of lake opposite the long-established Tilbury field.

The company has drilled three wells so far this season, two of which were commercial. Plans are to drill one further offset well to an established producing well, some 7½ miles offshore. The company plans to shift interest inland for the remainder of the year.

El Paso. This company has just brought in its first successful well. First two wells drilled last year had a small gas show, but were not commercial. Production potential has not yet been established on the new well, but estimates at this stage are about 1 million cubic feet daily after fracturing.

El Paso plans to drill 10 to 12 more wells this season. Holds huge acreage spread in eastern end of the lake.

Long Point Gas & Oil. This firm is drilling its seventh well this season off Mohawk Point in the Port Maitland area. So far it is batting 50% this season—three commercial wells and three noncommercial. The wells drilled this year are in the 500,000 cu. ft. daily and better category. The company thinks the chances of success are good on the present well. It plans to drill eight more wells this season.

Long Point has some 22 commercial wells—16 off Port Maitland and 6 off Port Dover. The Port Mait-

land wells have higher-than-average production potentials for the lake and one of the wells brought in last year was the biggest to date with an open-flow initial test of 5.5 million cubic feet daily. Last year the company drilled 10 wells, all commercial. All wells have been hooked up to Union's onshore distribution system. Company plans to continue its drilling program next year.

Place Gas & Oil. This firm has just recently brought in its third commercial well in Lake Erie in this season's drilling program. This is No. 16 in Walpole-Selkirk gas field, some ¾ mile offshore from Peacock Point. This well is running a little better than 500 M.c.f.d. on early open-flow tests.

The company plans to drill three more offshore wells this season. It got one of the biggest wells early in June—its Place 24 Walpole located 4 miles offshore. The well tested 2,150 M.c.f.d. without treatment. This is in a southerly extension of the Walpole-Selkirk field.

Place now has a total of 21 commercial gas wells in Lake Erie—17 in the Walpole-Selkirk field and 4 in the Port Dover area. All but this summer's wells are hooked up to shore distribution systems.

The company has just signed a farmout agreement with French Petroleum of Canada and United Canso Oil & Gas Co. for a joint drilling venture of Place's acreage in Malden Township in Essex County. This will be the company's first land venture. Place will be the operator and will be going for the Trenton oil zone around 2,500 ft.

Pennsylvania discovery well tops Oriskany pay

IN PENNSYLVANIA, New York State Natural Gas Corp. drilled a discovery well in Cameron County, north of the Hicks Run field. This strike is on the same general trend as the Boone Mountain pool of Clearfield County, but the discovery is 18 miles to the northeast of that field.

The discovery well, A. Pardee estate 3 in Shippen Township, found production in the Oriskany sand at 6,771 ft. After fracturing, the well produced 6,039 M.c.f.d. at a rock pressure of 3,420 psi. in 15½ hours.

Other wildcats. Two other wildcats completed were the 1 Revak in Crawford County on the Indian Springs trend and the New York State Mid-Penn Coal Co. well in Clearfield County. The 1 Revak, a Sun Oil Co.-Atlas Drilling Co. well, found salt water in the Oriskany and a show of gas in the Newberg. It was plugged and abandoned after reaching the Ordovician at a total depth of 3,959 ft. The Mid-Penn Coal Co. well, drilled by New York State Natural, found a show of gas and salt water in the Oriskany at 8,006 ft. It was plugged and abandoned at 8,151 ft., total depth.

Phillips Petroleum Co.'s third well along the Belford-Blair County line found some salt water in the Oriskany and 300 M.c.f.d. at a rock pressure of 2,670 psi. in 4 days.

The 2 F. Kapp well, drilled by Biery et al. in Warren County, has been completed as a Medina gas well feeding 170 M.c.f. against a back pressure of 595 psi. The rock pressure was 1,335 psi. The Medina was found at 5,650 ft. with the well being completed at a total depth of 5,778 ft.

In Crawford County, Benedum-Trees completed a development well on the Indian Springs trend in the Medina section for 2,500 M.c.f.d. after fracture. Rock pressure was 1,000 psi. Total depth was 3,828 ft.

In Du Bois pool of the Punxsutawney Driftwood field, Lee Minter et al. completed a field well in the Oriskany sand at total depth of 7,273 ft. with an open flow of 3,450 M.c.f.d. at a rock pressure of 3,889 psi. in 132 hours.

Ohio's Trempealeau Cambrian discovery details released

In Ohio, United Producing Co., Inc., has released completion data of a significant new-field discovery well in Canaan Township, Morrow County.

Reported initial production of this test was 200 bbl. of oil per day through ¼-in. choke. Shut-in rock pressure was 1,123 psi. The top of the Trempealeau of 1 Orrie Myers, Section 33, was found at 2,918 ft. and the pay was treated with 1,000 gal. of acid through perforations from 2,918-76 ft.

Seismograph and gravity surveys conducted in the region indicate a sub-Trenton "high" of unknown magnitude. The current lease play has now been extended 10 miles surrounding the discovery. First oil production from formations at or near this zone was found in Claridon Township, Marion County, in 1919 about 12 miles northwest. In 1959 a producer was completed in Bennington Township, Morrow County, about 17 miles southeast.

Two followup offsets on this tract are now under test. United has a fourth location drilling north of the tract on 1 Bush and Levering, in Section 28.

Pennsylvania shallow well completions

for second quarter 1961

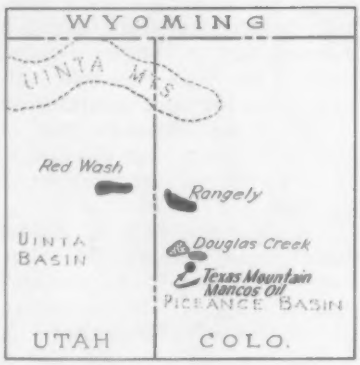
County—	Total	Oil	Gas	Dry	Service	Footage	D.D.
Armstrong	15	0	15	0	0	48,478	4
Butler	1	0	1	0	0	1,875	0
Clarion	4	0	3	1	0	6,731	1
Clearfield	1	0	1	0	0	2,508	0
Elk	1	0	0	1	0	2,000	0
Greene	0	0	0	0	0	0	1
Indian	5	0	4	1	0	15,781	1
Jefferson	2	0	1	1	0	6,066	2
McKean	68	35	0	0	33	123,894	6
Potter	1	1	0	0	0	1,460	0
Venango	3	1	0	1	1	3,028	0
Warren	2	2	0	0	0	1,674	0
Washington	1	0	0	1	0	2,015	0
Westmoreland	7	0	6	1	0	23,281	0
Total	**111**	**39**	**31**	**7**	**34**	**238,791**	**15**
Drilled deeper	15	3	7	2	3	10,899	..

Important oil discovery shapes up for Colorado

A BIG oil discovery is in the making in northwestern Colorado at Continental Oil Co. 1 Texas Mountain-Government in SE SE 14-3s-102w, Rio Blanco County.

The well flowed 127 bbl. of 39.8°-gravity oil per hour through 1-in. choke on flow line during tests in the Mancos shale at 4,516 ft. Further tests will be made.

This important discovery is located 2½ miles southwest of Douglas Creek gas field. It is slated as a Dakota Cretaceous test to 5,400 ft. Continental has several wildcats planned for southwestern Rio Blanco County, all in the Douglas Creek-Dragon Trail-Missouri Creek areas.



PROLIFIC Mancos Upper Cretaceous oil production is reported at a wildcat in the Piceance Creek basin of northwestern Colorado.

Mexican strike points the way to Sierra Madre foothills play

THE OUTSTANDING discovery of 1960 in Mexico was the opening of Cerro Nanchital field, a Cretaceous producer in the Isthmus region. This strike opened an extensive area of Cretaceous promise in the foothills of the Sierra Madre.

Most of last year's exploratory work in Mexico was again centered in the Cretaceous and Upper Jurassic formations of the Tampico Embayment and in the Tertiary formations of the Isthmus and Tabasco regions, and in northeastern Mexico.

Wells drilled. There were 762 wells completed in Mexico in 1960. This is an increase of 72.8% over the 441 wells drilled the previous year. Total footage was 5,273,314 ft. There were 176 wildcats drilled, 76 of them successfully.

... Northeastern Mexico. There were 66 wells completed here last year. Wildcats accounted for 40 of these. The wildcats included four new gas fields, two new gas pools, two new deeper gas pools, and three extensions to older areas. Of the 26 field wells drilled in this region, 15 were successful.

Material is based on "Petroleum Devtlopments in Mexico in 1960," AAPG Bulletin, July 1961.

Of the four new gas fields opened in northeastern Mexico, two were Eocene producers, two were Oligocene. The two new Eocene fields are Ceniza and Benavides; new Oligocene finds are Comitas and Palito Blanco. Ceniza field is a terrace, 16.8 miles northeast of China in Nuevo Leon State. The structure lies in the same trend of El Pato and Culebra fields. Initial daily output of 1,600,000 cu. ft. was tested at 4,232-47 ft. in the Wilcox Eocene.

Benavides field is along the same structural trend of Pato-Culebra and Ceniza fields. The 1 Benavides went to total depth of 9,840 ft. A daily output of 33,000 cu. ft. was reported at 4,986-5,004 ft. in the Mount Selman Eocene formation. The output here was small, but the find is quite significant. The discovery of pay sands this far south on the structural trend makes this area highly favorable.

Comitas field was opened 37.5 miles west of China in Nuevo Leon. It was apparently a northeast-dipping monocline. The 1 Comitas flowed 3,600 M.c.f.d. from 5,204-14 ft. in the Vicksburg Oligocene.

Palito Blanco field was opened 31 miles southeast of Reynosa in Tamaulipas State. Several pay sands were found between 6,800 and 8,200 ft. The discovery was completed at 7,268-78 ft. flowing 3,467 M.c.f.d. in Frio Oligocene sands.

... Tampico. There were 367 wells drilled in this region, an increase of 74.8% over the previous year's score. Wildcats accounted for 57 of these wells.

The five new field strikes were in Cretaceous rocks. Cabellal field was opened southeast of the structural trend of San Andres-Gran Morelos fields. The 3 Cabellal discovery went to 10,501 ft. in Upper Jurassic red beds. Pay was found at 9,692-9,774 ft. in porous limestones of the lower Tamaulipas formation of Lower Cretaceous age. Daily output was 497 bbl. on initial test.

Rancho Nuevo field was opened on an anticlinal structural west of the Golden Lane reef and parallel to it, 13 miles southeast of Ozuluama, Verecruz State. The 3 Rancho Nuevo well was drilled near the southwestern plunge of the anticline. Production was 518 bbl. per day from 6,429-45 ft. in the Tamabra limestone of Middle Cretaceous age.

Pital y Mozutla field was opened at No. 101 well. Pay was found in the Tamabra at 7,111-50 ft. Initial daily production was 1,535 bbl. of oil. This is a highly important discovery since it found several anticlinal structures with similar facies changes in the Cretaceous limestones that run parallel to the Golden Lane reef. Discovery well is located 6.9 miles northeast of Poza Rica in Veracruz State.

San Miguel del Rincon field was opened on a structural nose 12.5 miles southeast of Papantla, Veracruz. The No. 4 well found porous and permeable lower Tamaulipas fractured limestones of Lower Cretaceous age. It completed pumping 126 bbl. per day at 10,184-10,283 ft.

La Laja field was opened 14.2 miles north of Tres Hermanos field at 1 La Laja. Pay is the Tamaulipas fractured limestones at 8,301-38 ft. Initial pumping output was 126 bbl. This well went into Kimmeridgian formations where no permeability or porosity was reported in this Upper Jurassic limestone.

... Veracruz Embayment. There were four new-field wildcats drilled here, looking for oil in the Upper

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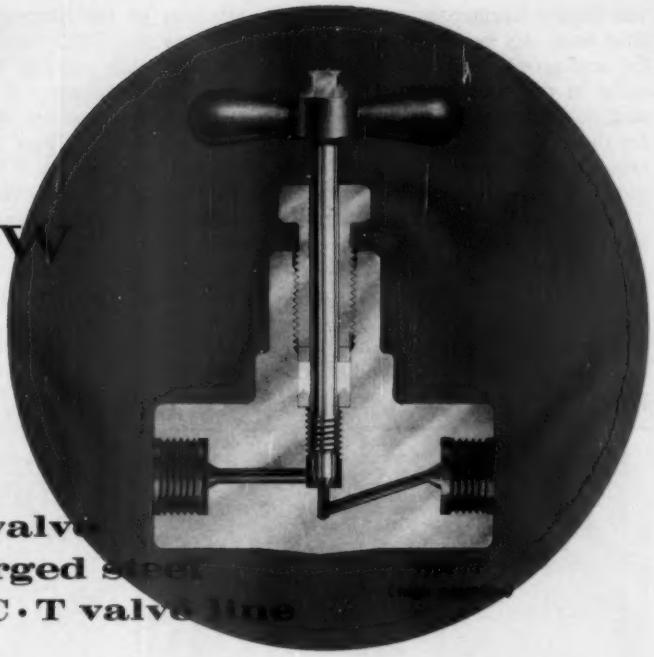

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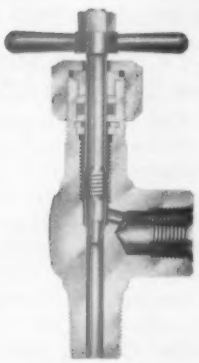

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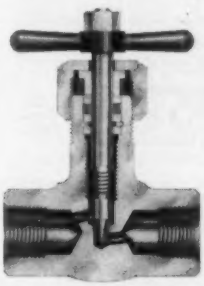

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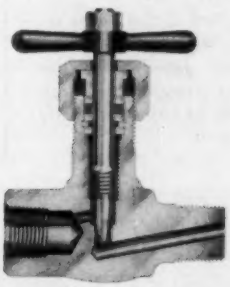

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and Middle Cretaceous sections. All four were dry holes. Both geological and geophysical work will continue in this area in 1961 to find and detail some Jurassic prospects for the drill. Only Tertiary and Cretaceous prospects have been explored in this embayment.

... Isthmus and Tabasco region. Surface geological work was carried out in the foothills of the Sierra Madre in North - Central Chiapas State. Anticlinal structures reflected in Cretaceous, Eocene, and Oligocene sediments were mapped. Geophysical crews worked in the western part of the Macuspana basin.

There were 323 wells drilled in the region last year, up 83.5% over the previous year. Wildcats accounted for 73 wells, 49 of them successful. There were 6 new gas and oil fields tapped; 7 new oil and gas pools; 8 deeper-oil pools; 7 shallower oil and gas pools, and 21 extensions to known fields. An 86% success ratio was recorded in field development drilling.

La Central field was opened 31 miles west of Huimanguillo, Tabasco State. The discovery well is located on the crestal zone of a dome within the Saline basin. It is believed to be on a deep-seated salt dome. Total depth was 12,697 ft. in the Filisola formation of Upper Miocene age. Completion was for 126 bbl. per day from 2,848-58 ft.

Xoteapa gas field was opened on the eastern flank of the Acalapa salt dome, 19.2 miles southeast of Coatzacoalcos, Veracruz. Daily output was 586,146 cu. ft. of gas from the Encanto formation of Miocene at 4,347-60 ft.

Yucateco oil field is in the Isthmus Saline basin. The discovery well flowed 303 bbl. of oil per day from an Encanto sand at 6,864-75 ft. This anticlinal structure at Yucateco is part of the structural saline trend on which La Venta field is located. It may be a long extension to that field.

Samaria oil field is located in the Macuspana basin, 10.6 miles northwest of Villahermosa in Tabasco. The No. 2 Samaria went to 11,384 ft. in Eocene. Initial production was 94 bbl. of oil per day in the Zargazal Middle Eocene at 2,625-58 ft.

Tamulte gas field is 15 miles northeast of Villahermosa. The first well was dry, but the No. 2 flowed 1,694 M.c.f.d. at 2,280-90 ft. in Middle Miocene sand.

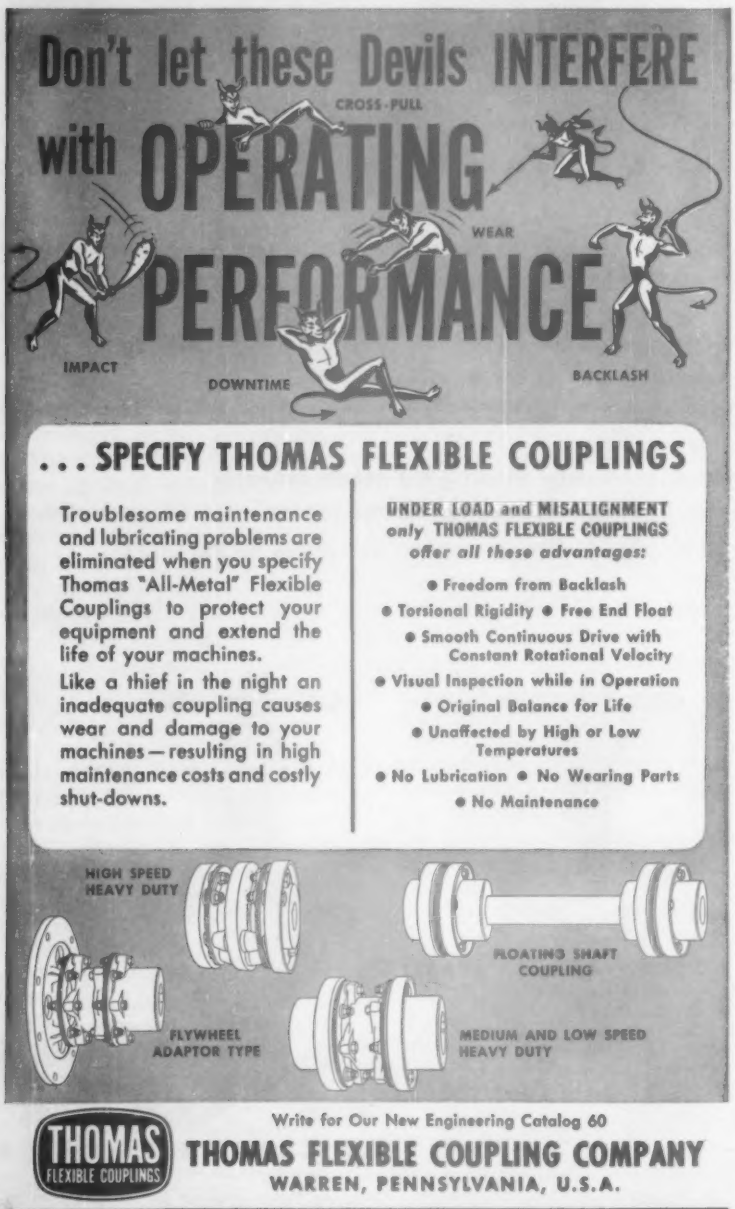
Cerro Nanchital oil field, south of the Saline basin and 50 miles southeast of Coatzacoalcos, was opened for 310 bbl. of oil per day from Cretaceous pay at 3,332-55 ft. This is one of the year's most important discoveries in Mexico. It opens an extensive area for Cretaceous exploration on the front ranges of the Sierra Madre.

One new oil pool for Illinois in July

One new oil pool, Bluford in Jefferson County, was discovered in Illinois in July.

There were also eight extensions to pools: one each to Clay City West and Ingraham in Clay County, Main Consolidated in Crawford County, Thompsonville North in Franklin County, Eldorado Consolidated in Saline County, Glenarm in Sangamon County, Covington South in Wayne County, and Phillipstown Consolidated in White County.

Three new pay zones were discovered in oil pools in July. Oil was discovered in the St. Louis lime in Clay City West pool in Clay County, in the Hardinsburg sand in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Omaha pool in Gallatin County. and in the Kincaid sand in Phillipstown Consolidated pool in White County.

A total of 197 new oil and gas tests was completed in the 5-week period. The new tests resulted in 80 oil wells, a success ratio of 41%. In addition, five wells that previously had been completed as dry holes were reworked or deepened and recompleted as oil wells.

Several very good oil-well completions were reported in July in Edinburg West pool in Christian County. Atkins and Hale completed the 4 Ricci-Rink Community in 4-14n-3w, for an initial production of 410 bbl. of oil a day from Silurian lime topped at a depth of 1,710 ft. The 3 Ricci-Rink Community, also drilled by Atkins and Hale, and the 3 Wheeler Hobbs Community drilled by A. & A. Oil Co., both in 4-14n-3w, were completed for initial potentials of 385 and 370 bbl. of oil a day, respectively, from the same pay zone. Other good wells, with initial potentials over 150 bbl. of oil a day from Silurian lime, were reported completed in the area.

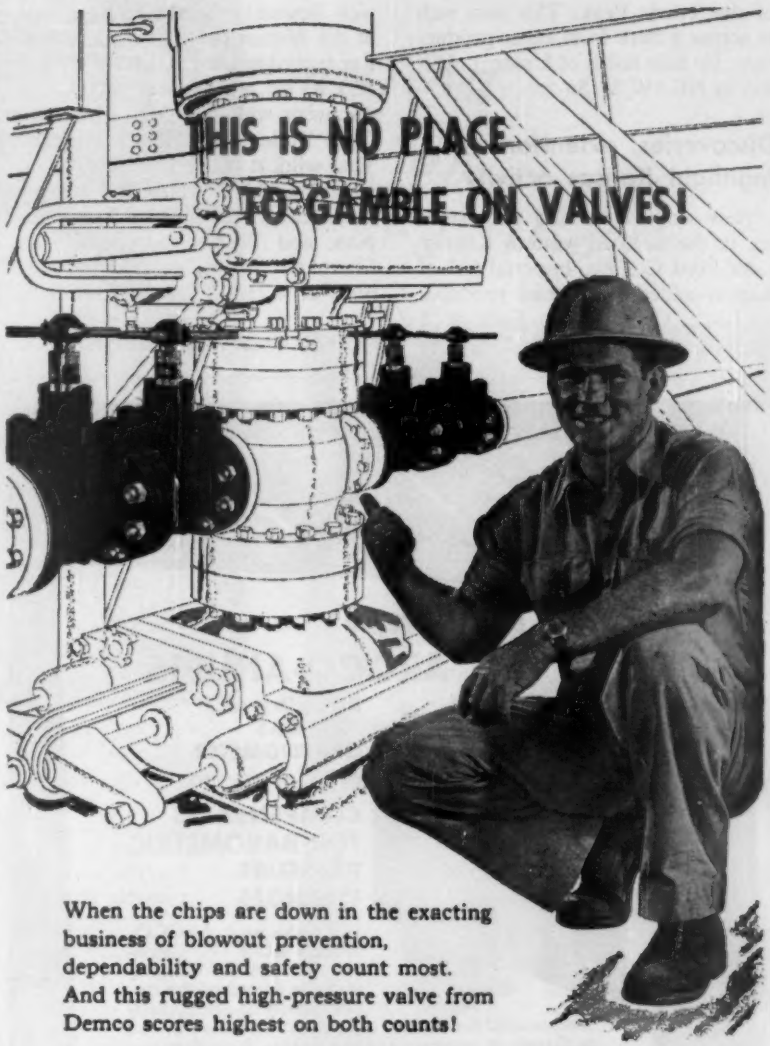
Estimated production for Illinois in July is 6,512,000 bbl.

North Louisiana reworked hole makes nice producer

An old deep hole in North Louisiana was reentered by Javelin Oil Co., Inc., and made a good oil producer. The 1 George W. Tigner, Jr., NE NE 5-22n-6w, originally drilled to 10,510 ft. in 1958 and abandoned, flowed 240 bbl. of 48°-gravity oil per day through ¼-in. tubing choke from perforations in the Smackover Jurassic "C" horizon between 10,279 and 10,348 ft.

Location is ¾ mile southwest of Union Producing Co. 1 Tigner unit in 33-23n-6w in Colquitt field. That well was a Taylor Cotton Valley producer at 8,917-27 ft. The new well is across a fault on the upthrown side.

Liberty Hill gas. John Franks et al. completed 1 J. H. Allison in 5-15n-5w, Liberty Hill field, Bienville Parish, northwestern Louisiana, flowing 3,414 M.c.f.d. and 34 bbl. condensate per day through 16/64-in. choke from perforations at 7,850-58 ft. in Hodge-Hunt sand



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of the Travis Peak. This new well is across a fault from other production, ¼ mile north of Union 1 Allison in NE SW 5-15n-5w.

Discoveries, extensions highlight Kansas activity

New discoveries and extensions are in the news in western Kansas.

In Ford County, Imperial Oil of Kansas added the second producer to Little Coon Creek field at 1 Torline, C NE SE 33-25s-21w. The well flowed 1 M.M.c.f.d. on tests of the Mississippian at 4,773-85 ft. Recovery included 500 ft. of oil and 150 ft. oil and gas-cut mud. The discovery well here was Mack Oil Co. 1 Butler in SE NE 33-25s-21w. That wildcat made 10½ bbl. of oil and 12½ bbl. of water from perforations at 4,792-99 ft. in Mississippian, and 10 bbl. per hour from Cherokee Pennsylvanian perforations at 4,715-22 and 4,732-36 ft.

Clark County. Sinclair Oil & Gas Co. 1 Tuttle is an indicated discovery in C NW SE 3-35s-21w. This wildcat flowed 2,600 M.c.f.d., from Chester Mississippian sand at 5,591-5,607 ft. Location is 12 miles southeast of Ashland and 2 miles south of Southwest Snake Creek field.

Haskell pair. Pan American Petroleum Corp. got two discoveries in this county. The 1 Lemon Gas unit "F," C SW 22-30s-33w, 2 miles north of Hopkins field and east of the town of Satanta, flowed 577 M.c.f.d. from Morrow Pennsylvanian sand at 5,349-58 ft.

The other discovery is 1 Black Gas unit "C" in C SW NE 17-30s-33w, 2½ miles north of Victory field. This well flowed 4,260 M.c.f.d. from Lansing Pennsylvanian at 4,134-89 ft. ft. Free oil also was reported on the drill-stem test.

New Morton pay. Thomas & Brewer found a new pay in Berryman Wabaunsee gas field, Morton County. The 1 U. S., C NW 15-33s-41w, 1 mile northeast of the field discovery well, flowed 1,350 M.c.f.d. during test of the Winfield Permian at 2,228-93 ft. This was a 1959 discovery of Panhandle Eastern Pipe Line Co. at 1-21 Berryman "B," C NE 21-33s-41w, 6½ miles south of Richfield. The discovery flowed only 880 M.c.f.d. from Wabaunsee at 2,897-99 ft.

Activity brisk in all Northwest Oklahoma sectors

Harper Oil Co. tested gas from Tonkawa Pennsylvanian sand at 2 Barby unit, C NW SE 4-3n-26eCM, Mocane district, Beaver County, Oklahoma Panhandle, to contribute to the still-fast going play in northwestern Oklahoma.

The well flowed 3,600 M.c.f.d. on 1-in. choke from perforations at 5,408-22 and 5,455-78 ft.

Shell Oil Co. will drill a geological test in the Guymon field, Texas County, at 1-8 Fisher, C SW NE 8-3n-16eCM. Drill will go to 6,700 ft. or Morrow sand. This deep test was 3 miles west of Southwest Hook field, nearest deep production.

Shell gaged gas at 1 Deal-State in C NE SW 13-24n-25w, Ellis County wildcat between Southwest May and Luther Hill fields. The

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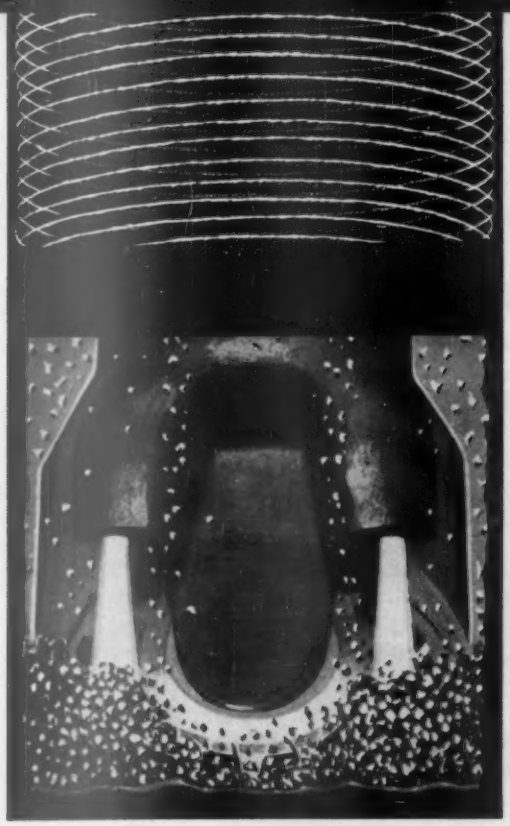
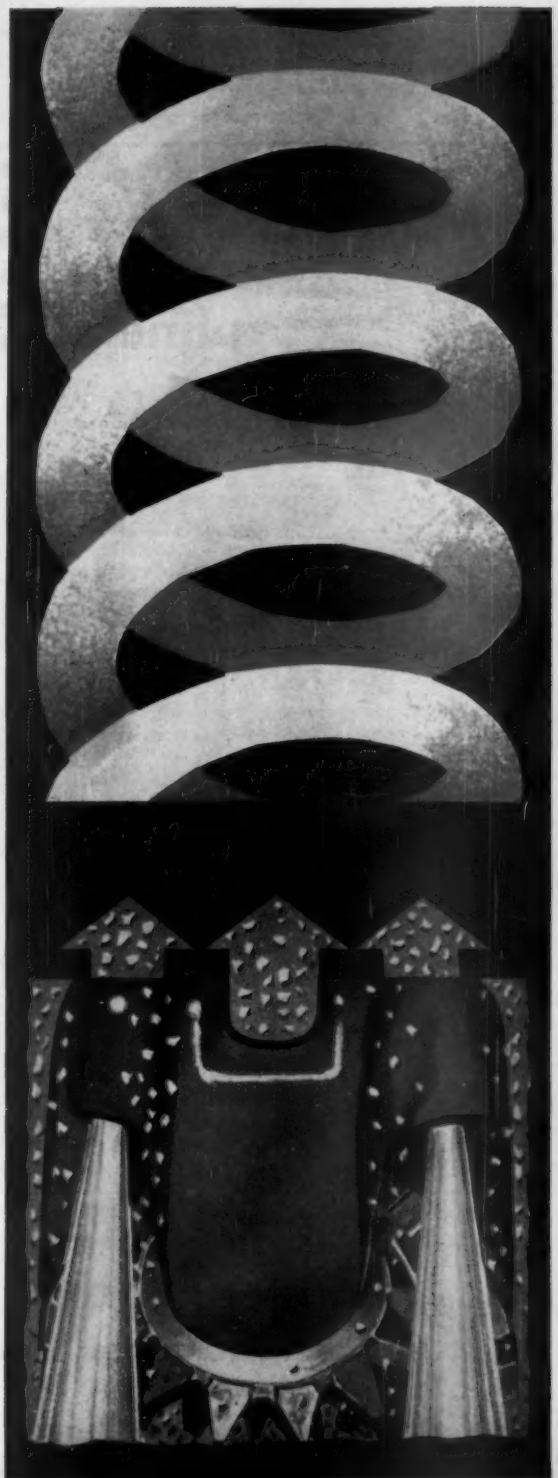


milling or drilling?



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well flowed 504 M.c.f.d. from perforations at 7,968-74 ft. Pan American extended the north side of Northeast Catesby field at 1 McFarland-C, C NW SE 12-24n-26w. This Morrow well flowed 2,730 M.c.f.d. from perforations at 7,873-77 ft.

Shell staked the first offset to a new oil discovery on the west side of Southwest Hooker field in Texas County. The 1-14 Dorsch, C NE SW 14-4n-16eCM, will attempt confirmation to the 1 Honemann in C SW NE 14. That discovery flowed 422 bbl. of oil in 21 hours through ½-in. choke from upper Morrow sand perforations at 6,255 to 6,281 ft.

Mid-American Minerals proved Morrow oil production at 1 Bartel in C NW SE 18-2n-23eCM, northwest of West Elmwood field in Beaver County. The well flowed 384 bbl. per day on test at 7,267-98 ft.

Development spreads in Dewey County, Northwest Oklahoma

West Valley Center and Lenora fields in Dewey County, northwestern Oklahoma, near linkup. Mobil Oil Co. completed an east extension discovery in West Valley Center pool to open first production in 18-17n-17w. The 1 Cox Unit, NW SE NW, flowed 10,200 M.c.f.d. plus 48 bbl. condensate per million from Oswego lime at 9,005-45 ft.

Amerada Petroleum Corp. staked a wildcat northeast of this area at 1 Thomsen Unit, C NE SW 24-18n-18w. This 10,500-ft. test will try to join main production in Lenora field with production in the extension area of 30 and 31-18n-17w. Asland Oil & Refining Co. staked 1 Vanderwork in C SW NE 5-18n-17w to look for Chester at 10,000 ft. This one is 4 miles northeast of production.

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Dual discovery reported in northwestern Oklahoma's Ellis

Ellis County in northwestern Oklahoma has a new dual discovery well at Falcon Seaboard Drilling Co. 1 Phillips in C SE NW 13-24n-24w.

The well flowed 11,700 M.c.f.d. from perforations at 7,670-92 ft. in Morrow sand and 4 M.M.c.f.d. from perforations at 7,802-20 ft. in Chester Mississippian. Location is 2 miles east of Luther Hill gas field, separated by an 8,000-ft. duster.

Beaver County. Mid-America Minerals, Inc., 1 Bartel, C NW SE 18-2n-23eCM, flowed 28 bbl. of oil per hour, natural, from perforations at 7,266-76 ft. in upper Morrow sand. This new discovery is 1¼ miles northwest of oil production.

Second well completed at Ella Fimble in Southwest Texas

New 2,100-ft. Frio sand production is reported at Forrest C. Lattner 2 Ella Fimble in Goliad County, Southwest Texas. This is the second well to be finaled there.

The 1 well, 2,200 ft. southeast of No. 2, flowed 42 M.M.c.f.d. from 2,500-ft. Frio sand. The new producer made 2,100 M.c.f.d. from perforations at 2,113-15 ft. Location is 8 miles northwest of Goliad in the Jacob Fifer Survey, A-120.

Texas coast. In Grimes County, Texaco Inc. worked over 1 R. P. Trant in Ferguson Crossing field,

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finding 4,700 M.c.f.d. from a shallow Wilcox sand at 2,166-76 ft. The well is 7½ miles northwest of Piedmont in the BBB&C RR Co. Sur., A-124. Original completion in this well was from 1,726-32 ft. in Queen City. Flow was 3,230 M.c.f.d.

Jefferson County. Meridith & Co. et al. recompleted 2 William Doornbos et al. as a dual gas-condensate well in Port Arthur field.

Absolute open flow of 31 M.M.c.f.d. was reported from upper Hackberry C perforations at 11,136-44 ft. From lower Hackberry F zone at 11,350-59 ft. the well flowed 11,500 M.c.f.d. This well previously had been completed in the Hackberry at 11,276-86 ft. for 130 M.M.c.f.d.

Davis sand discovery finaled in Denton County, North Texas

Denton County in North Texas has a new gas discovery at Carter-Gifford Oil Co. et al. 1 M. A. Knox, located in the southwest part of the county.

The well flowed 1,380 M.c.f.d. on calculated absolute open-flow gage. Production is from Davis sand at 5,161-93 ft. Location is in the A. C. Madden Survey, A-852, 4 miles north of Justin in an area of no previous production. The Cordell at 5,873-6,003 ft. is also being tested for production.

Big Throckmorton well. Big dual completion is reported at a wildcat in Throckmorton County. Currey Oil Co. 1 Atkinson, 5 miles southeast of Throckmorton in the central part of the county, flowed 271 bbl. of oil per day on 14/64-in. choke from upper Caddo limestone perforations at 4,128-34 ft.; from Conglomerate at 4,625-35 ft., the well flowed 260 bbl. of oil per day on 14/64-in. choke. Location is 1¼ miles south of East Throckmorton Mississippian field in Section 1, TTRR Sur., A-881.

Cherokee Pennsylvanian hit finaled in Texas Panhandle

Roberts County in the Texas Panhandle reported new Cherokee sand production at D. E. Pinion 1 G. H. Mahler.

This new strike flowed 375 bbl. of oil daily on 12/64-in. choke from perforations at 9,579-9,614 ft. Location is in Section 27, Block 44, E. E. Polly Survey, 12 miles west of Canadian and 3 miles south of Parsell Morrow sand gas-condensate field.

Green River basin adds new Almond sand discovery

Almond Cretaceous Mesaverde production is reported at a wildcat about 3½ miles west of Patrick Draw field in Sweetwater County, Wyoming. The discovery is Chandler & Simpson 1 Ver Brugge-Government in C SE NE 2-18n-100w.

The operator completed the new pool-opener for 1,500 M.c.f.d. and 6 bbl. condensate per day flowing through 21/64-in. choke. Production is from 2,361-71 ft. in the Almond sand. This is the fourth wildcat in a series drilled in this region by the company. One of the first wells also found gas in the Almond sand.

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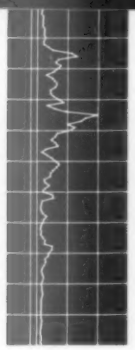

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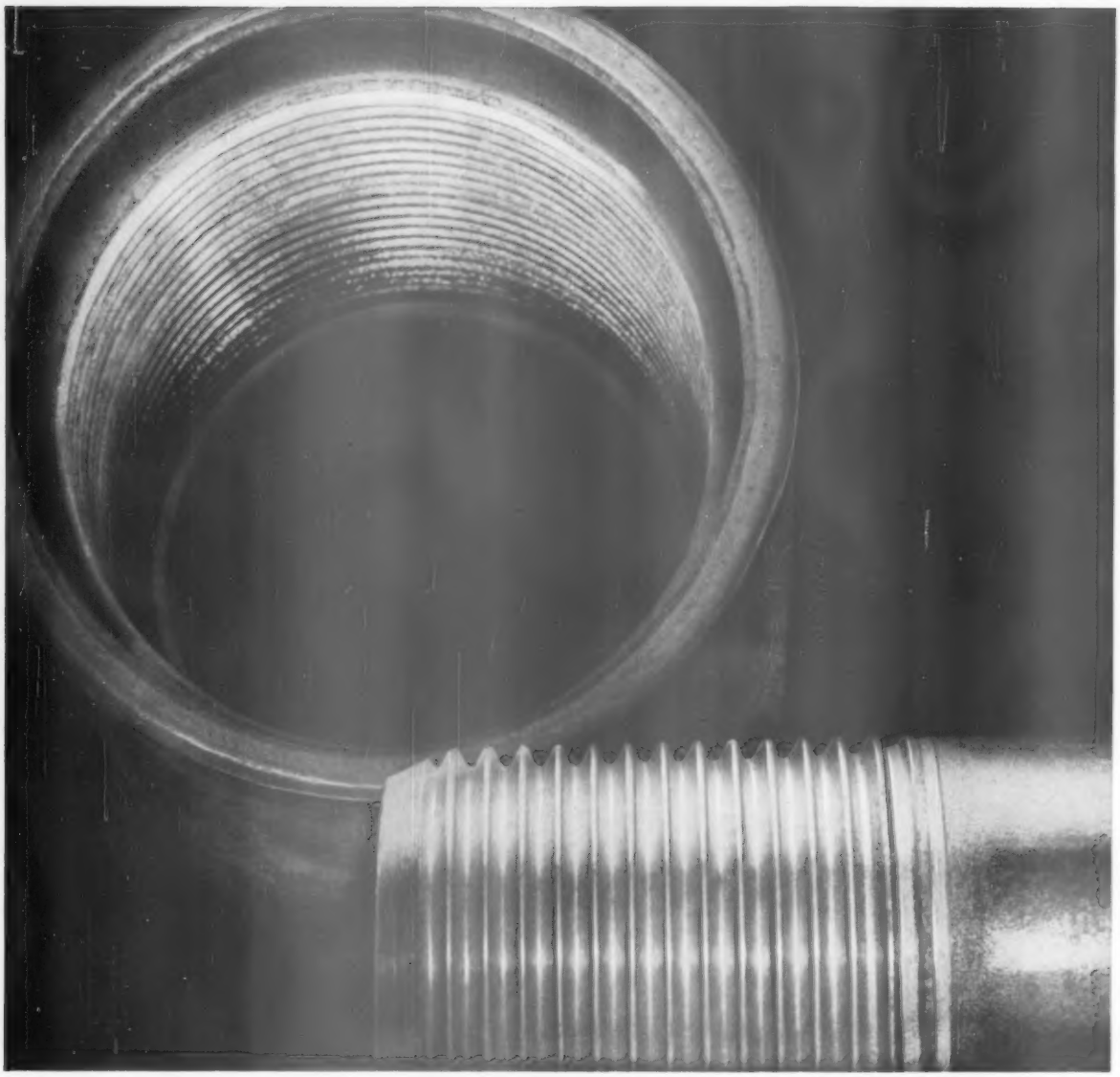

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Short stories from here and there:

Oil discovery completed in northeastern Arizona

An oil discovery was completed in Apache County, northeastern Arizona. The well is Atlantic Refining Co.'s 1-7 Navajo in 7-40n-29e.

Completion was for 143 bbl. of oil per day and 102 bbl. of salt water. Perforations were at 5,604-18 ft. in Mississippian. Location is about 1½ miles due east of Dry Mesa field, containing three producers from Mississippian. Texas Pacific Coal & Oil Co. opened that field 2 years ago at a 240-bbl. per day Mississippian discovery. Two producers and one dry hole have been added since.

Deep producer completed in Wayne County, Illinois

In Wayne County, Illinois, Collins Bros. 1 Wood "A", NE NE NE 32-2s-9e, flowed 13 bbl. of oil per hour, natural, through ⅛-in. choke from Dutch Creek sand at 5,346-58 ft. This well opens a new pay for the Golden Gate field. Location is 3 miles south of Golden Gate.

In White County, 3 miles west of Crossville and ½ mile or more from production, E. F. Moran 1 Ingram, SW SW SE 17-4s-10e, flowed 30 bbl. of oil per hour after acid treatment in O'Hara lime at 3,161-77 ft.

Gas discovery completed off Louisiana coast

Offshore gas production was reported at a wildcat in Block 16, off Vermilion Parish, South Louisiana. The Gulf of Mexico strike is Ocean Drilling & Exploration Co. 1 State Lease 3763, located in the northwest corner of the block.

The well, now shut in, flowed 5 M.M.c.f.d. on 14/64-in. choke from perforations at 12,266-74 and 12,287-94 ft.

Louisiana's St. Martin Parish has dual gas-condensate hit

Dual gas-condensate production is reported at a wildcat in St. Martin Parish, South Louisiana. The discovery well is Wacker Oil Co. 1 Edwin E. Willis in 48-7s-6e.

The well flowed 100 bbl. of condensate per day with 2 M.M.c.f.d. from perforations at 9,654-58 and 9,986-92 ft. The lower zone made 144 bbl. of oil per day on 8/64-in. choke. Location is 5 miles east of Arnaudville field.

Plaquemines offshore. A dual discovery is reported offshore from Plaquemines Parish at Continental Oil Co. 5 State Lease 987 in Block 82, West Delta area.

The well flowed 1,023 M.c.f.d. through 14/64-in. choke from lower zone perforations at 2,316-26 ft. Through 12/64-in. choke at 1,702-12 ft. the well flowed 591 M.c.f.d.

Michigan strike may confirm pool

In Michigan, Perry Fulk 1 Klosowicz, NE SW NW 26-7s-15w, Cass County, located 1,320 ft. north of Perry and Son's 710-ft. Traverse oil discovery, drilled oil pay at 700 ft. to apparently confirm pool.

Two other offsets are drilling along with two outposts from 1-2 miles out of the discovery area.

Osceola Pipe Line Co. has completed arrangements to move St. Clair crude oil to Detroit and Ohio refining points through the Buckeye pipeline that extends from Toledo northeast to Marysville, Mich., where it junctions with the Canadian oil line. Osceola will junction the Buckeye line at Richmond. Up to this time St. Clair crude has been moved by truck. The several fields in the area are producing about 2,500 bbl. per day.

With switch over to pipeline, Osceola announced 5-cent price increase, from $2.75 to $2.80 bbl.

First Permian production opened in Nebraska's Dundy

Foraker Permian production was officially opened in Nebraska at Sterling Drilling Co. 1 Dunn in C SE NE 31-3n-36w, Dundy County. The well pumped 95 bbl. of oil per day, cut 4% water. Production is from Foraker perforations at 3,824-30 ft. and 3,859-63 ft.

Location is about 5 miles northeast of the only other production in the area with oil above Oread-Pierce Lake in SE SE 8-2n-37w. That area has a small Admire Permian and Lansing-Kansas City Pennsylvanian producer.

Discovery well confirmed in Lea County, New Mexico

A reentry well in southwestern Lea County, Southeast New Mexico, 10 miles southeast of Maljamar, was completed as a flowing Queen Permian sand producer. The well is McMahon, Wiley & Lowe 1 Mobil-State, an east offset to a recently opened Queen sand pool.

The confirmation well flowed 491 bbl. of oil per day on 28/64-in. choke from perforations at 3,952-64 ft. Location is in 36-17s-33e, ½ mile south of Vacuum field. Old total depth of the confirmation well was 9,250 ft. It had been a dry hole previously.

New Mexico's Rio Arriba play gains momentum

Mobil Oil Co. got 343 bbl. of oil per day at 1 Boulder-Apache in SW NW 14-28n-1w, Rio Arriba County, northwestern New Mexico. This well is a southeast offset to the P&M Drilling Co.'s Gallup discovery at 1 Bayless in NE NE 15-28n-1w. Production is from Gallup open hole at 4,150-4,429 ft. This new field, yet unnamed, is 9 miles north of Puerto Chiquito Gallup Cretaceous field.

Gas gaged at western Pecos County test in Texas

Multiple-pay Hershey field in western Pecos County now has Pennsylvanian gas production. Atlantic Refining Co. 1 Willbanks Hersehenson Gas unit, 1 mile northwest of the 1 Kelly discovery, flowed up to 6,500 M.c.f.d. on tests of the Pennsylvanian through perforations at 15,150-15,300 ft. Location is in Section 7, Block 51, T-10, T&P Survey, 30 miles west of Fort Stockton. The Kelly well is Texas' deepest producer at 16,680 ft. in Montoya Ordovician. The field has Devonian, Fusselman, and Ellenburger production.

Concho County, West Texas has indicated Penn strike

An indicated Pennsylvanian discovery looms in Concho County, West Texas. The well is Sunray Mid-Continent Oil Co. 1 Ella Houston, 2 miles east of Paint Rock and in Section 1, AB&W Survey, ¾ mile east of Paint Rock gas field.

The well flowed 117 bbl. of oil per day from perforations at 3,456-64 ft. This would open new production for this part of Concho County.

Terrell County. Shell Oil Co. 1 Mitchell-331, 16,000-ft. Ellenburger try 2 miles southeast of Brown-Bassett field, flowed 20 M.M.c.f.d. at 13,176 ft. Location of this well is in Section 331, TW&GN Survey, 25 miles south of Sheffield.

Dane discovery confirmed in Major County, Northwest Oklahoma

A northwestern Oklahoma field was confirmed by Pan American Petroleum Corp. The 1 Martin-B in C SW NE 9-20n-13w, Major County, confirms Dane pool.

South of the first producer in the field, the Martin well flowed 7,529 M.c.f.d. on 12-hour test through open 2-in. choke. Perforations were in the Chester Mississippian lime at 7,625-29 and 7,702-44 ft. The discovery well of Dane field was 1 Elwell in C SE NW 4-20n-13w. That well flowed 8,720 M.c.f.d., open flow, from perforations between 7,510 and 7,670 ft. Completion was last spring.

Austin chalk discovery finaled in Maverick County, South Texas

Austin chalk production is reported at a wildcat discovery in southeastern Maverick County, Southwest Texas. The new strike is Union Producing Co. 29-1 Halsell, 23 miles southeast of Eagle Pass in Section 29, Block 11, I&GN Survey, A-970.

The well flowed 276 bbl. of 36.2°-gravity oil per day on ¼-in. choke from perforations at 4,038-4,138 ft. Requested name for the new field is Halsell. There is no comparable production in this part of the county.

Karnes County discovery is new Edwards producer

A new Edwards field was tapped north of Person field in Karnes County, South Texas. The discovery is Standard Oil Co. of Texas 1 Theo Labus.

The well flowed 245 bbl. of 39°-gravity crude per day on 15/64-in. choke from perforations at 10,800 ft. in the Edwards lime. Location is 7 miles northwest of Helena in the Jos. Curtis Survey, A-81. It lies 4,800 ft. north of Shell Oil Co.'s 1 Pawlek Edwards discovery.

Arnold David area in South Texas, gets strike

A wildcat discovery was completed by Arnold O. Morgan et al. at 43-1 Chapman heirs, 6 miles southeast of Petronilla in Nueces County, South Texas.

The well is 1½ miles northeast of Arnold David field. Flow was 170 bbl. of 60.3°-gravity oil per day through 9/64-in. choke from perforations at 6,940-46 ft. Recommended name for the new field is North Arnold David, with proposed pay called the Hight sand. Locatjon is in Section 43, Laureles Farm Tracts.

Pennsylvanian producer finaled in Pecos, West Texas

Flowing Pennsylvanian production is reported at a wildcat in Pecos County, West Texas. Ormand Brothers Drilling Co. 1 Ayres, located in the northern part of the county, 5 miles southwest of Grandfalls, is an old well reentered.

Flow was 116 bbl. of 46.2-gravity oil per day through 20/64-in. choke from perforations at 8,456-68 ft. Location is in Section 79, Block 8, H&GN Survey. It lies ½ mile west of shallow Payton-Yates field.

Ector County. Texaco Inc. 20 Ida McDonald is the second Wolfcamp Permian producer in South Jordan field, Ector County.

This dual completion flowed 362 bbl. of oil per day on 18/64-in. choke from Wolfcamp perforations at 6,692-6,702 ft. and 6,722-28 ft. Location of the Ellenburger and Wolfcamp well is in Section 27, Block B-16, PSL Survey.

Pecos County. Odessa Natural Gas Co. et al. 1 Wilbanks, Hershey field well, 15 miles west of Fort Stockton, flowed 1 M.M.c.f.d. during tests at 13,197-15,427 ft. Location is in Section 19, Block 50, T&P Survey.

Reagan County. Phillips Petroleum Co. 1-B Hartgrove, 6 miles west of Stiles, flowed 4 M.M.c.f.d. from Devonian perforations at 11,084-11,252 ft. Location is in Section 1, Block M, TCRR Survey, 3 miles northeast of Centralia Draw field.

Granite test in Meade County, Kentucky

An important test has begun in Meade County, Kentucky, where Bill Duchscherer is deepening the 1 Lester Pack to granite. The Pack well is located 2,800 ft. from north line and 1,800 ft. from west line of 13-R-41. Elevation is 633 ft.

The 1 Pack is located in the graben area of a large faulted anticline whose axis trends northeast-southwest. This structure is substantiated by shallow drilling and is aligned along a strong positive magnetic trend. Louisville Gas & Electric Co. has a multiple gas-storage field on the east side of this structure.

Granite is expected at approximately 4,000 ft. The nearest granite test is some 100 miles to the northwest where the Indiana Farm Bureau Co-Op 1 Luther Brown topped the granite at 6,650 ft.

Some of the expected potential pay zones will be the Trenton, Black River, Chazan series, Knox zones, Eau Claire, and Mount Simon sands.

Drilling contractor is Carrol Meister of Greenville, Ky.

Discovery wells

ALASKA

Kenai Peninsula

Standard Oil Co. of California and Richfield Oil Corp., 1 Falls Creek, SE NE SW 6-1n-12w in Clam Gulch area. Flowed 1,950 M.c.f.d. from 7,600 ft. TD 13,789 ft. New-field discovery.

CALIFORNIA

Sutter County

Sacramento Oil & Gas Co. 1 Osterli center NW¼ NW¼ 4-11n-4e. Flowed at rate of 5,200 M.c.f.d. from Upper Cretaceous G zone from 5,705-20 ft. TD 5,762 ft. New-field discovery.

R. W. Heath Moves to Key Spot

. . . as executive vice president of Signal Oil & Gas Co.

Veteran executive was one of the founders of the company.

RONALD W. HEATH, one of the real veterans of the Signal Oil & Gas Co. organization, has moved into the key spot of executive vice president of the company.

In his new job, Heath will be moving out of his post as senior vice president and head of the gas department and into one that calls for coordinating Signal's world-wide operations. These operations include an integrated domestic set-up and production and exploration work in Venezuela, Argentina, the Neutral Zone, and Iran.

The Los Angeles-based company, while considered an independent, has grown considerably both at home and abroad in recent years. Signal has a big stake in foreign oil. The company owns 50% of a joint venture in Venezuela's Lake Maracaibo and 30% of American Independent Oil Co., which has a concession in the Neutral Zone.

In tapping Heath for the executive vice presidency, Signal's management picked one of the four Signal executives who helped found the company with Chairman Samuel B. Mosher back in 1923. The others are President Russell H. Green, and two senior vice presidents, Garth L. Young and O. W. March.

Heath had been out of Stanford University only a short while when he joined the company. At the time, Signal's primary asset was a 22,000-gal. natural gasoline plant at California's Signal Hill field, from which the company gets its name. Heath, long considered a top man in the natural-gasoline field, has helped the company grow from its one plant on Signal Hill to its present integrated and international status.

Ronald W. Heath
. . . problems can't be solved overnight.

He's a former president of the California Natural Gasoline Association and has served as vice president of the Natural Gasoline Association of America (now NGPA).

While primarily associated with the gas and natural-gasoline ends of the business, Heath also has a solid background in other areas due to his long service (since 1948) as a director of the company.

Oil's outlook . . . The veteran oil man sees some hopes of better days ahead for the industry—but he's far from optimistic about a quick solution to all oil problems. He thinks the industry can solve its problems, but not overnight.

The weather will be the key to whether the industry earns a good profit in the months ahead. The high stocks and shaky prices can be eliminated if cold weather provides the demand needed. This is true both for refined products and LPG.

Underground storage is one element which is "hard to evaluate" in the LPG picture. Heath feels increasing underground storage may eliminate today's practice of dumping surplus stocks at distress prices. Too, he points out one reason production has been too high is that several large natural-gasoline plants have gone on stream in recent months. This trend is not expected to continue indefinitely.

Today's LPG market is tough, but Heath recalls the time in the early 30's when Signal wasn't showing a profit on its natural-gasoline operations. At the time, product was selling for ¾ cent a gallon. Everytime the market firmed up, a new supply came along which drove the price back down to a profitless point. But the market in the 30's improved and Heath expects today's LPG market to take an upturn.

Washington is one trouble spot where Heath sees little likelihood of things getting better quickly. He says the industry needs to work hard to erase the feeling that "you're guilty until proven innocent." The trends he sees in the nation's capital point to more rather than fewer controls.

"This is probably true for other industries, too," he says. "I don't know. We've got so many problems of our own that we can't follow the other fellow's problems."

However, neither the Washington problems nor others facing the industry have killed Heath's optimism. He's looking forward to Signal's continued growth in the world-wide oil patch.

▶▶▶ Personals

J. Paul Costa, reservoir engineer with Humble, has been transferred to Kingsville, Tex., from Houston.

Name of Farrar Drilling Co., Mount Vernon, Ill., has been changed to Farrar Oil Co. The firm has opened a new Rocky Mountain exploration office in Denver with **Wilson G. Harris, Jr.,** chief geologist and partner, in charge. **Charlie A. Tucker, Jr.,** will join the company September 1 as geologist in the Mount Vernon office.

Chester Roberts, special sales representative in DX Sunray Oil Co.'s Memphis marketing district, has been promoted to district manager. He succeeds **Sam Caldwell,** who recently retired after 35 years with the company.

Dr. S. K. Alley has joined Union Oil Co.'s Brea, Calif., research center as senior research chemist.

William H. Nichols has joined Skelly Oil Co. in Tulsa as manager of a new crude-oil department. He will supervise crude-oil purchases and sales. Nichols was manager of the crude-oil section of the supply and transportation department of Standard Oil Co. (Ohio) in Cleveland before joining Skelly.

▶▶▶ Personals

N. T. Bogart, assistant general manager of the manufacturing department of Standard Oil of California, Western Operations, Inc., has been named vice president and general manager of the manufacturing department. He succeeds **J. T. Higgins,** who has been given a new assignment with the parent company. Higgins will be associated

BOGART

STEVENS

with **G. A. Davidson,** vice president and director in charge of manufacturing, engineering, and research. **P. N. Johnson,** vice president of California Oil Co., western division, will succeed Bogart. **A. E. Stevens,** assistant general manager, wholesale, in Western Operations' marketing department, has been named president of Signal Oil Co., California Standard marketing subsidiary. Stevens succeeds **D. F. Godfrey,** who has moved to the parent company to work with **G. J. O'Brien,** vice president for governmental relations.

W. E. Farrar, head of Union Oil Co. of California's Houston land department, has been transferred to Calgary as president of Union Oil Co. of Canada, a subsidiary. The change results from a reorganization of Union's Canadian holdings.

J. M. Bond, administrative assistant to Crown Central Petroleum Corp.'s vice president, refining, has been named general manager of supply and transportation. He succeeds **A. J. Morris,** who resigned to join Permian Corp., Midland, Tex. Bond will be responsible for pipeline and crude-oil operations. He will move to Baltimore from Houston. **C. W. Van Wagoner,** crude-oil pipeline representative, has been named manager of pipeline operations with headquarters in Houston. **D. R. Harris,** administrative assistant, has been named manager of crude-oil purchases and sales. He will also headquarter in Houston.

W. L. J. Fallow has been named project manager for Canadian Bechtel, Ltd., on Western Pacific Products & Crude Oil Pipelines' crude and products line from Taylor to Kamloops, B.C. Other Bechtel personnel assigned to the project are **Glynn Jones,** office engineer; **Herbert W. Branum,** construction engineer; and **I. Roy Martin,** project administrative engineer. Canadian Bechtel will manage engineering and construction of the entire line and will build a 145-mile northern section. **M. A. Finnerty** is superintendent of this construction.

William W. White, a section head in Service Pipe Line Co.'s engineering department, has been temporarily assigned to Casper, Wyo., where he will take over the duties of **R. H. Christman,** division chief engineer. Christman is on special assignment in North Dakota.

M. D. Curran, president of Century Refining Co., subsidiary of Panhandle Eastern Pipe Line Co., has been named assistant to the president of Panhandle. **Arthur L. Naylor** has been named assistant superintendent of the transportation division of Panhandle's gathering and transmission department.

Marion J. Cummins, district gager for Texas Pipe Line Co. in Electra, Tex., has retired after 40 years with the company.

Service Pipe Line Co. is consolidating operations in Oklahoma and Kansas into one operating division. **O. O. McKenzie,** Oklahoma division manager, will be in charge of the consolidated operations with headquarters in Wichita. **H. M. Hill,** Kansas division manager, has been assigned to the Missouri-Illinois division with headquarters in Galesburg, Ill. **Ellis Orr,** assistant manager of the Missouri-Illinois division, has been assigned to the Oklahoma-Kansas division as assistant manager. The Sterling, Colo., district, formerly a part of the Kansas division, will become a part of the Wyoming division. **Opal Blair** is Sterling district superintendent, and **R. R. Strand** is Wyoming division manager.

Harold F. Clary has been appointed senior vice president of Signal Oil & Gas Co. Clary joined Signal in 1925. He was named general counsel in 1953 and has been vice president in charge of the legal department and a director for the past 7 years. Clary's appointment was made at the same time that **R. W. Heath,** vice president, was elected executive vice president of Signal (see p. 159).

CLARY

Miller Swaney, deputy to Esso Research & Engineering Co.'s chemicals vice president, has joined Enjay Chemical Co. as product manager for rubber. **Bill Lifson,** who has been serving on rotational assignment as assistant manager of research for Humble, has returned to Esso Research as special assistant to the vice president for petroleum products and medical, analytical, and basic research.

J. R. Williams, Salt Lake City independent operator, has been elected Rocky Mountain Oil and Gas Association vice president for Utah and Idaho. He succeeds **Grant A. Brown,** Amoco Chemicals Corp.

T. H. Lambdin, field foreman with Texaco in Levelland, Tex., has been transferred to Midland, Tex.

Richard J. Loeffler has been named Standard Oil Co. (N. J.) assistant coordinator of production for Europe, the Mediterranean, and Africa. Loeffler has been with Humble in Carmi, Ill.

Glenn D. Rucker, head of ethylene operations at Monsanto Chemical Co.'s Texas City plant, will be responsible for ethylene manufacturing operations at the company's Chocolate Bayou plant near Alvin, Tex. He also will be responsible for integrating Texas City and Chocolate Bayou ethylene operations. **R. D. Updegrove** has been named a general supervisor in the Chocolate Bayou hydrocarbons department. **Whitney W. Wilson** has been named traffic manager, Chocolate Bayou.

Charles T. Draney, vice president, international division, for Bechtel Corp., has been elected a director of the company. Draney has been with Bechtel since 1937 and has been a vice president since 1951.

Jack C. Bendler, district petroleum engineer for Honolulu Oil Corp. in Brownfield, Tex., has joined Western Development Co. of Delaware as petroleum engineer in Artesia, N. M.

Roger Pemberton, technical representative for Canadian Aero Service, Ltd., in Toronto, has been named head of the new exploration division of Aero Service Corp. He will headquarter in Philadelphia. Pemberton is a past president of Canadian Exploration Geophysical Society.

Humble will streamline Rocky Mountain operations by consolidating its Rawlins, Wyo., and Salt Lake City exploration offices and merging the Riverton, Wyo., office into the Casper, Wyo., district. The merger of offices will be completed around October 1. **J. B. Coffman,** head of the Rawlins office, will be

COFFMAN

NORMARK

district exploration manager in the enlarged Salt Lake City office. **R. M. Normark,** now head of the Riverton office, will be Casper district exploration manager. **Calvin Cooksey,** in charge of the Salt Lake City office, will move to Denver as area exploitation geologist. In Salt Lake City, **D. H. Turner** will be in charge of the land department and **N. E. Ries** will be head scout. **Ragner Johnson,** Billings, Mont., will move to Salt Lake City as head of geology. **Helmut Kasiske,** Ardmore, Okla., will move to Salt Lake City as head of geophysics. In the Casper office, **R. J. Waldram** will be head of the geological department and **M. A. Young,** head of geophysics. **Sam L. Harris,** land man in Pittsburgh, will move to Casper as district land man. **W. K. Calmes** will be head scout. **M. P. Dahill** will move to Casper from Riverton as geologist. **B. A. Duby,** geophysicist, will move to Casper from Rawlins. Riverton personnel not moving to Casper include **G. F. Bechner,** geophysicist, who will be assigned to Houston; **L. E. Laird,** land man, who will move to Denver; and **H. F. York,** geologist, who will move to Pittsburgh. Rawlins personnel who will not move to Salt Lake City include **H. Y. Crouse,** senior geologist, who will move to Billings; and **R. J. Leman,** who will become district land man in Pittsburgh.

Frank O. Jobe, Jr., regional transportation manager in Fort Worth for Continental Oil Co., has been promoted to assistant to the vice president in charge of transportation and supplies. He will headquarter in Houston.

W. R. Lucas, formerly with Atlantic Refining Co., has joined Union Texas Natural Gas Corp. as project engineer in the petrochemical department.

Julian Mote, supervisor in the additives division at Humble's Bayway refinery, Linden, N. J., has been named unit supervisor in the alcohol-ethylene division, chemical-products department. He succeeds **Ken Altreuter,** who has been named head of the receiving, packaging, and shipping division at Bayway. **Bill Bradshaw** will succeed Mote in the additives division.

Richard W. Ballmer has been promoted to hill process superintendent at the Cleveland No. 1 refinery of Standard Oil Co. (Ohio). **Gordon J. Good** will succeed Ballmer as yard process superintendent at the refinery.

W. C. Brodhead has been named manager of Gulf Oil Corp.'s marine department in New York. Brodhead had been departmental coordinator of transportation in the Pittsburgh office. In New York he succeeds the late Carl F. Vander Clute. **Peter B. Binsted,** managing director of Gulf's marine agency in Antwerp, Belgium, has been named manager of transportation for Gulf Eastern Co. in London. He succeeds **R. G. Martin,** who recently resigned.

▶▶▶ Personals

Leroy Gideon has formed Gideon Oil Co., exploration and production firm, in Fort Worth. Gideon had been associated with **T. F. Hodge,** Fort Worth independent, for the past 3 years. He was with Rowan Drilling Co. and Rowan Oil Co. for 14 years before that time. He served the Rowan companies as geologist and production superintendent and was vice president in charge of production in 1958 when Rowan Oil was merged with Texas Pacific Coal & Oil Co.

GIDEON

Robert E. Sheriff, chief geophysicist for Dominion Oil, Ltd., in Port of Spain, Trinidad, has been transferred to Western Australia Petroleum Co. in Perth, Australia.

F. L. Newby, vice president of California Crude Sales Co., a subsidiary of Standard Oil Co. of California, has been appointed manager of natural-gas utilization for the parent company. Newby has been with the California Standard companies since 1935 and had held the California Crude Sales post since 1956.

Dr. Ronald T. Macdonald, technical specialist on the staff of California Research Corp.'s vice president for petroleum products, has been named research associate. **C. D. McLean** has been promoted to supervising research engineer in the petroleum products-research department. He will headquarter in Louisville, Ky., as Cal Research representative. **A. S. Brengle** has been appointed assistant to the laboratory director at the La Habra, Calif., lab. Also at La Habra, **Dr. A. R. Loeblich, Jr.,** has been named senior research associate in paleontology, and **Dr. T. W. Spencer** has been promoted to senior research physicist, theoretical seismology. **D. F. Percival** has been named group supervisor in the chemical sales technical-service section of the Richmond, Calif., laboratory.

Personals

Joseph S. Badyk has been named head of the new natural-gas and crude-oil supply department of Canada - Cities Service Petroleum Corp. in Calgary. The new department will consolidate western Canada gas and crude-oil sales in the Calgary office. Badyk has been with Canada-Cities Service since 1952. He has served as office manager of the exploration and production divisions in Calgary and became assistant secretary and treasurer of the company in 1956.

Tidewater Oil Co. has moved headquarters of its South Texas district production office from Houston to Corpus Christi. **L. D. Lott** is district production manager and **S. H. LaCroix** is assistant production manager. Tidewater recently consolidated its Gulf Coast and South Texas exploration districts into a new South Texas unit in Corpus Christi. **J. P. O'Connor, Jr.,** is district exploration manager.

John C. Hayes has been named associate coordinator of platforming research for Universal Oil Products Co. in Des Plaines, Ill.

Primo L. Pinotti, product specialist in petroleum chemicals for California Chemical Co.'s Oronite division, has been named Chicago district manager of petroleum chemicals for the Oronite division.

J. Ian Jenks has been named resident manager for western Canada in the new Calgary office of Humphreys & Glasgow (Canada), Ltd. The company specializes in design and construction of gas treatment, petrochemical, chemical and industrial plants and in market and economic surveys. Canadian headquarters are in Toronto.

Harry C. Boyd-Snee, district representative in Bismarck, N. D., for Indiana Oil Purchasing Co., has joined Western Crude Marketers, Inc., as special representative in Bismarck. He will supervise Western Crude's activities in the Williston basin area. **R. L. Rasnic** has moved to Bismarck from Casper, Wyo., to succeed Boyd-Snee in the Indiana Oil Purchasing post.

Daniel G. Jones has been promoted to senior research chemist in Socony Mobil Oil Co.'s central research division, Paulsboro, N. J.

Bill Lovett, project leader with Esso Research & Engineering Co., has been named head of the motor-gasoline additives section. He succeeds **John Patterson,** who recently began a rotational assignment with Humble. **Norman Alpert** has been appointed head of Esso Research's agricultural-products section. He succeeds **Stan Tutwiler,** who has been named head of product-application research. Tutwiler replaces **Morris Morrow,** who has returned to Humble after a year's rotational assignment.

Pete Hoffman, Champlin Oil & Refining Co., has been elected chairman of the Fort Worth section of AIME's Society of Petroleum Engineers. Committee chairmen are: **Glenn W. King,** Pan American Petroleum Corp., program; **P. H. Griffin,** Salt Water Control, Inc., arrangements; **Ray Evans,** Welex, membership; and **Stanley V. Bowen,** Texas Pacific Coal & Oil Co., statistics. **J. D. Christner,** Ambassador Oil Corp., has been elected secretary-treasurer.

Deaths

Landon H. Cullum, 72, of Perkins & Cullum Oil Co., died August 15 at his home in Wichita Falls. Cullum had been active in the oil industry since 1912, when he joined Gulf Oil Corp. In 1917 he and a group of Wichita Falls men formed an independent company which was active in the Ranger and Desdemona field booms. This firm was sold in 1922 to Magnolia Petroleum, and Cullum and the late J. J. Perkins set up Perkins & Cullum Oil Co. The company is active in Texas and Oklahoma. Cullum helped organize Texas Mid-Continent Oil and Gas Association. He was active in backing passage of Texas' first oil conservation and proration laws.

Leo F. J. Wilking, 79, retired superintendent of Texaco's Casper, Wyo., refinery, died August 11 after a brief illness. Wilking joined Texaco in 1908 as chemist in Port Arthur, Tex. He moved to the Casper refinery in 1930 after assignments in Houston and Port Neches, Tex. He retired in 1947.

Albert S. Orr, 58, director of product-quality coordination in Gulf Oil Corp.'s refining department, died August 13 while vacationing in Long Beach, N. J. Orr joined Gulf at the Port Arthur, Tex., refinery in 1924. He moved to the refinery-technology laboratory in Philadelphia in 1930 and later served as director of the laboratory. He became assistant manager of the technical division in Pittsburgh in 1951 and director of product-quality coordination last year.

Oma Turk, 77, Plumer, Pa., drilling contractor and producer, died August 6 in an Oil City, Pa., hospital.

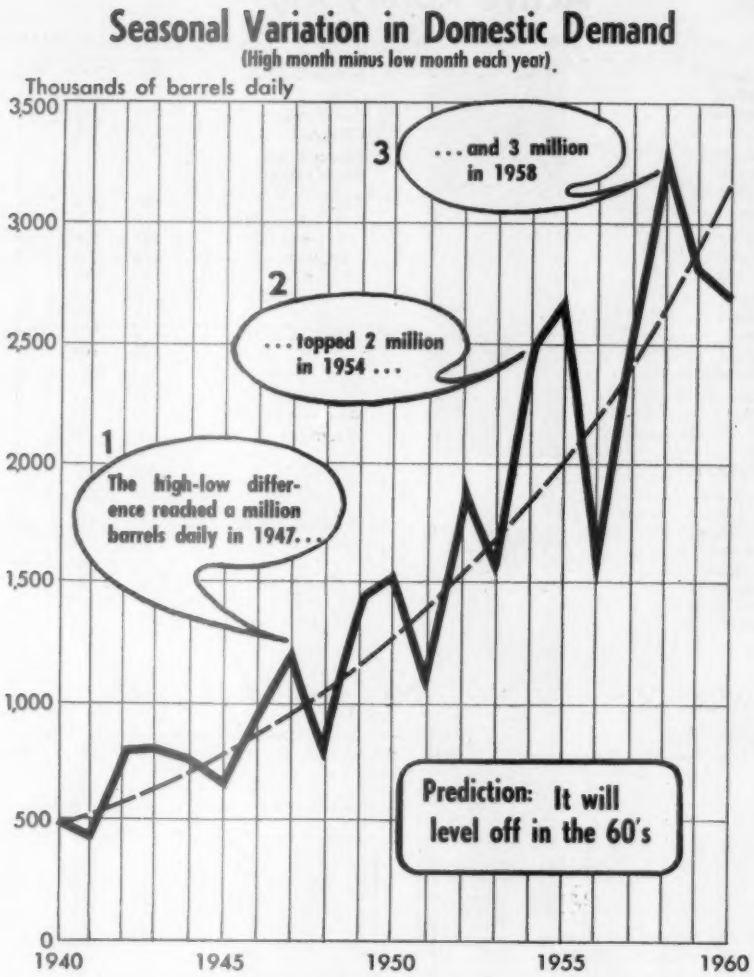
Laurence A. Curran, assistant vice president in charge of manufacturing for Aurora Gasoline Co., died July 31 after a long illness. Curran had been with Aurora 28 years. He was superintendent of the Detroit refinery before becoming assistant vice president 3 years ago.

Ray Smith Everitt, 70, Tulsa independent operator, died August 16 at his home after suffering a heart attack.

T. C. Fussell, 74, retired Cities Service engineer, died August 8 in a Sperry, Okla., nursing home. Fussell retired in 1957 after 33 years with the company.

Frank B. Whayman, 65, retired supervisor of gas testing for Shell Oil Co.'s Tulsa region, died August 10 in a Tulsa hospital of cancer. Whayman retired in 1959.

Wharton Weems, treasurer and one of the founders of Petroleum Equipment Suppliers Association, died August 4. Weems was a partner in Vinson, Elkins, Weems, & Searls, Houston law firm.



Demand shift calls for changes in runs

BY JOHN C. CASPER

BACK IN 1940 the difference between high-demand and low-demand months of a year amounted to only half a million barrels daily. In recent years the difference has been as much as 3 million barrels daily.

The shift in demand pattern calls for revised operating programs at refineries. If total demand for oil products climbs to better than 11,000,000 bbl. daily in January, many refiners will have to operate at capacity to meet requirements of their customers.

This high January demand may be followed by a drop to below 8,000,000 bbl. daily in May or June. Refiners tend to be slow on the cutback that is needed to prevent an overaccumulation of refined-product inventories in the early summer months. And, heavy inventories at this time of year supply an ideal breeding ground for product dumping, price wars, and reduced profits.

The chart shows rapid growth in the spread between high and low demand months from 1940 through 1960. Starting with about 500,000 bbl. daily in 1940, the growth was slow during the years of World War II. Military purchases accounted for a large part of demand, and there was very little seasonal change in war demands.

The sawtooth design by the graph shows there never was more than a 2-year rise or a 2-year drop without a change in direction. The largest reduction in the high-low spread was in 1956, and the largest gain was in the 2-year period 1956-58.

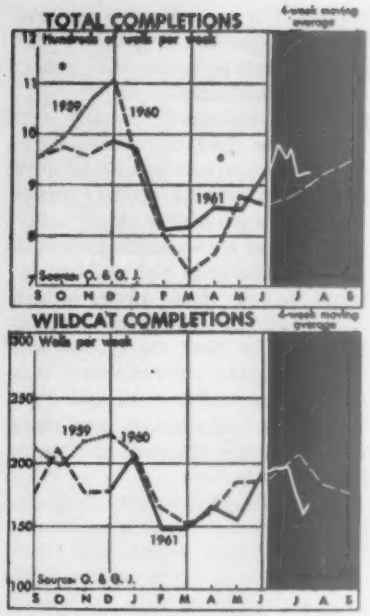
There is a good chance that December will be the high-demand month for a given year. In the 1940-60 period, December was the peak month for 16 out of the 21 years. Also, there is a 16-to-21 chance that the low month of the year will be in the May-August season.

The ever-increasing spread between winter and summer demands leaves the refiner with two choices for profit. He can tailor runs for a better fit with demand, or he can add extra tanks for product storage.

Plans for profit must give due consideration to changes in seasonal demand patterns. Subnormal prices have already trimmed better than a million dollars off refiner income so far this year.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,045,150	UP	5,840	UP	120,563
Crude stocks	255,187,000	DOWN	994,000	UP	14,024,000
Completions	829	DOWN	132	DOWN	123
Refinery runs	8,437,000	DOWN	29,000	UP	102,000
Gasoline stocks	192,098,000	DOWN	944,000	UP	260,000
Kerosine stocks	32,123,000	DOWN	177,000	UP	899,000
Distillate stocks	137,927,000	UP	5,052,000	DOWN	2,720,000
Residual stocks	50,005,000	UP	247,000	UP	6,036,000
Four-product stocks	412,153,000	UP	4,178,000	UP	4,475,000
Total imports	2,025,400	UP	351,600	UP	262,900



Active Rotary Rigs

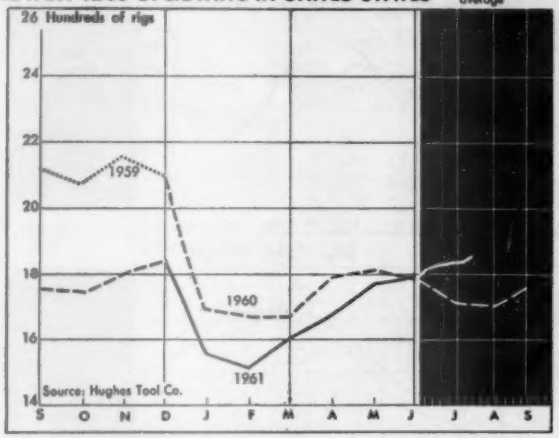
	8-14-61	8-7-61	8-15-60
Alabama	4	4	4
Alaska	11	11	7
Arkansas	15	12	13
Arizona	0	0	1
California	73	74	83
Land	71	70	81
Offshore	2	4	2
Colorado	30	31	37
Florida	1	1	2
Land	0	0	2
Offshore	1	1	0
Illinois	43	37	38
Indiana	8	10	9
Iowa	2	2	0
Kansas	107	107	100
Kentucky	3	3	3
Louisiana	267	267	299
North	42	38	41
S. Inland waters	103	106	121
S. Land	75	73	75
Offshore	47	50	62
Maryland	0	0	1
Michigan	28	28	41
Mississippi	68	63	61
Missouri	2	3	1
Montana	25	25	23
Nebraska	18	16	19
New Mexico	115	113	112
New York	1	1	0
North Dakota	17	17	16
Ohio	8	8	6
Oklahoma	214	216	163
Oregon	0	0	1
Pennsylvania	9	7	13
South Dakota	2	1	0
Texas	683	678	551
S. Inland water	9	7	5
S. Land	183	196	169
Offshore	2	2	0
North	67	64	44
Panhandle	72	72	39
East	68	70	45
West Central	158	159	152
West	124	108	97
Utah	34	34	30
Washington	1	1	1
West Virginia	13	13	5
Wyoming	68	66	62
Total U. S.	1,870	1,849	1,702
Cum. avg. to date	1,690	1,685	1,734
Western Canada	137	128	160
Eastern Canada	2	2	0
Grand total	2,009	1,979	1,862

Hughes Tool Co. report.

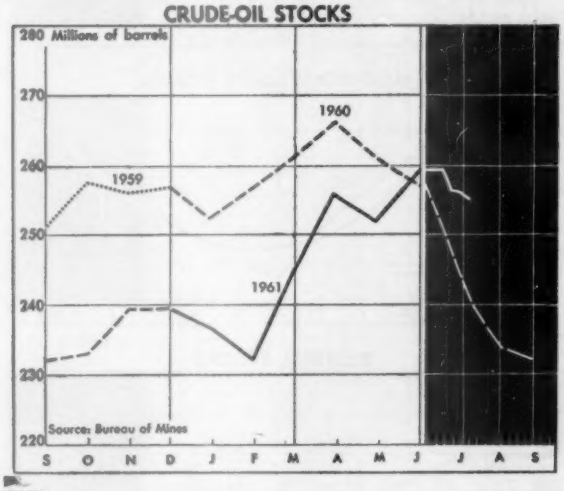
WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 12, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	0	0	0	0	0	0	0	31	31	0	0	0	0	0	7	2
Alaska	2	1	0	0	1	0	16,565	26	.....	1	0	0	0	1	4	.....
Appalachian	24	3	0	18	3	0	69,746	1,276	1,131	1	0	0	0	1	49	38
Arizona	1	1	0	0	0	0	5,782	14	25	1	1	0	0	0	9	18
Arkansas	11	4	0	3	4	0	42,746	308	366	2	0	0	1	1	63	99
California	39	29	0	5	5	0	163,322	1,007	1,016	3	0	0	0	3	158	193
Colorado	7	1	0	2	4	0	42,843	372	385	3	0	0	0	3	177	194
Illinois	36	17	0	0	19	0	76,867	1,158	1,293	14	3	0	0	11	262	280
Indiana	22	4	0	0	18	0	30,367	424	594	7	0	0	0	7	115	224
Kansas	63	24	0	4	31	4	221,829	3,217	1,959	16	1	0	0	15	596	636
Kentucky	26	11	0	2	12	1	35,439	1,216	1,093	3	1	0	0	2	88	114
Louisiana	147	75	16	6	50	0	1,273,350	2,311	2,140	26	1	0	1	24	366	337
North	37	19	3	1	14	0	120,002	901	791	9	1	0	0	8	155	161
South	79	35	10	2	32	0	808,368	1,072	1,039	15	0	0	1	14	176	154
Offshore	31	21	3	3	4	0	344,980	338	310	2	0	0	0	2	35	22
Michigan	25	3	0	3	14	5	63,577	452	534	8	0	0	0	8	167	145
Mississippi	9	3	0	0	6	0	100,533	333	427	4	0	0	0	4	111	161
Montana	8	3	0	0	5	0	44,145	229	185	4	0	0	0	4	109	89
Nebraska	26	9	0	0	17	0	120,833	627	537	14	2	0	0	12	301	221
New Mexico	33	18	0	7	8	0	171,833	1,086	1,143	3	0	0	0	3	180	179
West	17	7	0	7	3	0	85,849	487	378	3	0	0	0	3	59	41
East	16	11	0	0	5	0	85,984	599	765	0	0	0	0	0	121	138
North Dakota	6	4	0	0	2	0	41,801	161	184	2	1	0	0	1	42	49
Ohio	24	13	0	4	6	1	48,394	633	614	1	0	0	1	0	28	33
Oklahoma	53	22	1	5	22	3	226,290	3,592	2,919	9	2	0	1	6	353	473
Texas	243	132	10	11	85	5	1,130,111	8,899	9,794	66	13	1	1	51	1,847	2,041
Dist. 1	12	5	0	0	7	0	35,613	539	666	4	0	0	0	4	210	253
Dist. 2	12	4	2	1	5	0	70,968	485	465	5	0	0	0	5	130	115
Dist. 3	14	6	0	3	4	1	90,708	721	768	3	1	0	1	1	140	144
Dist. 4	14	7	3	2	2	0	87,449	768	670	3	0	1	0	2	180	190
East	15	6	0	0	9	0	86,059	761	784	9	0	0	0	9	190	166
Dist. 7-B	26	11	1	1	13	0	86,298	1,125	1,424	12	5	0	0	7	310	412
West	76	51	1	2	22	0	437,542	2,202	2,577	22	5	0	0	17	474	405
Dist. 9	58	28	3	0	23	4	175,033	1,573	1,799	8	2	0	0	6	159	315
Dist. 10	16	14	0	2	0	0	60,441	725	641	0	0	0	0	0	54	41
Utah	3	2	0	0	1	0	14,808	153	161	1	0	0	0	1	69	55
Wyoming	6	1	0	1	4	0	26,845	580	638	2	0	0	0	2	216	257
Misc. (Tenn.)	15	0	0	1	14	0	15,827	134	109	15	0	0	1	14	121	90
Total U. S.	829	380	27	72	331	19	3,983,853	28,239	27,278	206	25	1	6	174	5,438	5,928
Previous week	961	433	9	73	306	140	3,212,530	.....	.....	129	5	1	6	117	.....	.....
Cum. 1961	28,239	12,646	592	2,771	10,133	2.097	113,680,500	.....	.....	5,438	475	60	246	4,657	.....	.....
Cum. 1960	27,278	12,553	816	2,233	10,549	1,127	116,669,056	.....	.....	5,928	529	66	191	5,142	.....	.....
Western Canada	38	20	0	6	12	0	187,625	1,355	1,412	9	3	0	1	5	346	386

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	8-5-61	7-29-61	8-6-60
Pennsylvania	2,491	2,461	2,303
Other Appalachian	1,746	1,777	1,795
Illinois, Indiana, Michigan	10,554	10,601	9,650
Nebraska and North Dakota	3,720	3,658	2,922
Kansas	9,783	9,752	8,805
Oklahoma	17,019	17,124	16,541
Arkansas	1,953	1,907	1,814
Louisiana	20,611	21,109	18,024
North	3,374	3,718	3,246
South	17,237	17,391	14,778
Mississippi, Alabama, Florida	1,738	2,002	2,367
New Mexico	7,558	7,674	8,510
Texas	109,827	109,395	100,613
East Texas	8,914	9,593	8,174
West Texas	48,765	47,299	46,616
Texas Gulf	19,200	19,769	17,001
Other Texas	32,948	32,734	28,822
Wyoming	17,298	17,219	16,857
Other Rocky Mountain	9,633	9,982	9,565
California	23,899	24,316	27,222
Foreign	†17,357	17,204	14,175
Total	**255,187**	256,181	241,163

*Bureau of Mines. †Includes 4,739,000 bbl. in California.

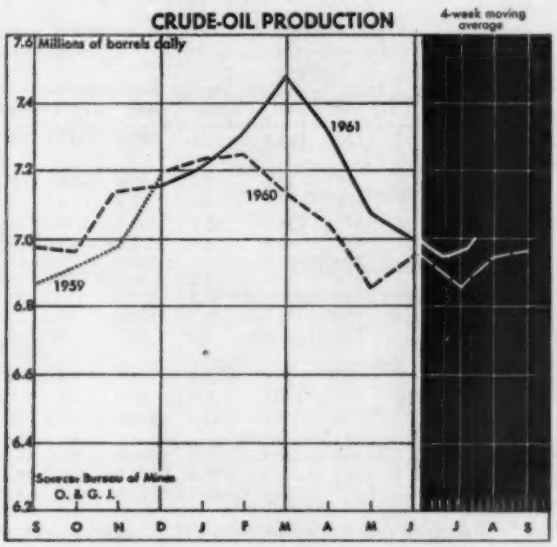
DAILY AVERAGE PRODUCTION FOR WEEK

	August 12, 1961 Crude oil	Lease condensate	Total	Aug. 5 total
Alabama	19,450	.....	19,450	19,425
Alaska	19,400	.....	19,400	19,200
Arkansas	78,100	100	78,200	78,150
California	814,000	.....	814,000	817,500
Colorado	124,450	.....	124,450	126,500
Eastern	41,000	.....	41,000	39,900
Florida	1,000	.....	1,000	1,000
Illinois	206,300	.....	206,300	209,100
Indiana	29,000	.....	29,000	29,300
Kansas	†308,200	.....	†308,200	†312,110
Kentucky	51,300	.....	51,300	50,700
Louisiana	997,250	137,700	1,134,950	1,133,275
North	106,250	5,200	111,450	111,500
South	891,000	132,500	1,023,500	1,021,775
Michigan	53,800	.....	53,800	53,300
Mississippi	146,600	3,650	150,250	150,375
Montana	86,400	.....	86,400	86,300
Nebraska	56,600	.....	56,600	61,500
Nevada	450	.....	450	450
New Mexico	315,000	7,500	322,500	313,925
North Dakota	55,500	.....	55,500	54,800
Oklahoma	†505,000	.....	†505,000	†515,250
Texas	2,418,000	89,650	2,507,650	2,481,950
Dist. 1	42,000	2,600	44,600	44,600
Dist. 2	100,000	7,900	107,900	106,625
Dist. 3	312,000	38,000	350,000	345,925
Dist. 4	176,000	12,500	188,500	184,850
Dist. 5	27,000	600	27,600	27,600
Dist. 6	113,000	8,000	121,000	116,500
East Texas Field	128,000	.....	128,000	125,650
Dist. 7-B	125,000	400	125,400	124,550
Dist. 7-C	103,000	3,450	106,450	109,875
Dist. 8	994,000	12,000	1,006,000	1,005,150
Dist. 9	193,000	2,500	195,500	183,925
Dist. 10	105,000	1,700	106,700	106,700
Utah	83,600	.....	83,600	85,600
Wyoming	395,450	.....	395,450	399,000
Others	‡700	.....	‡700	‡700
Total U. S.	6,812,550	238,600	**7,045,150**	7,039,310
Change from prev. week, up			**5,840**	.....
Canada	†624,150	.....	†624,150	†569,600

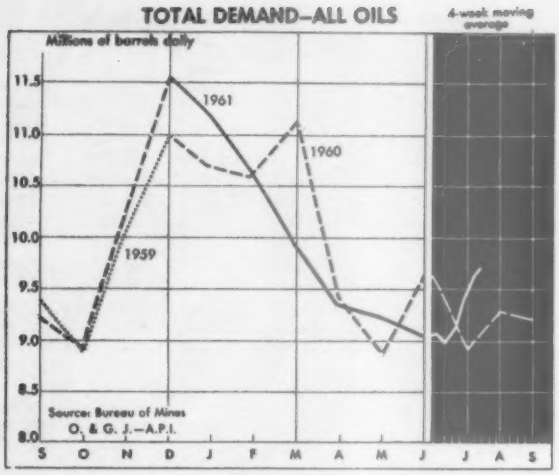
Total U. S. Prod.—Jan. 1-Aug. 12 ..... 1,611,421,200 bbl.
Same period last year (crude plus cond.) ..... *1,582,497,200 bbl.

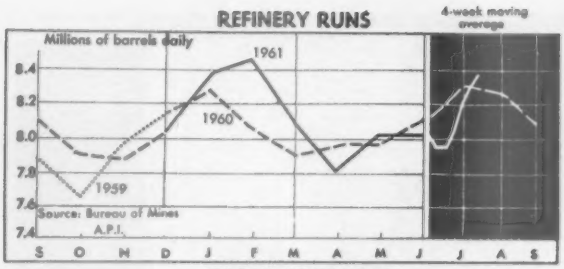
*Includes 51,236,000 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

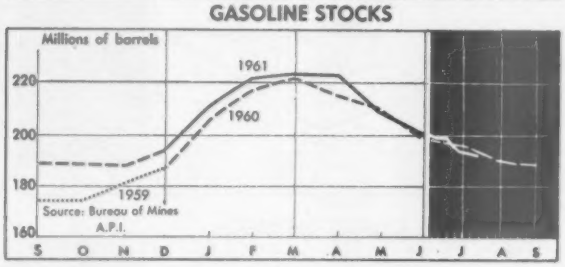
CRUDE-OIL PRODUCTION

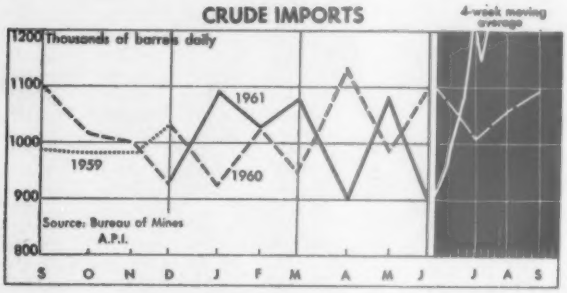


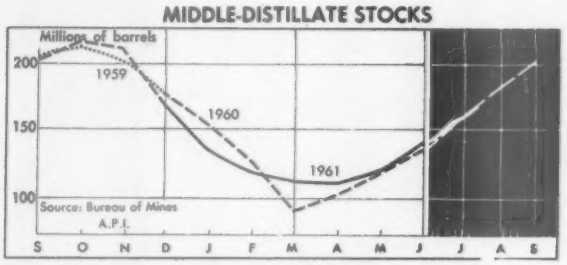
REFINING

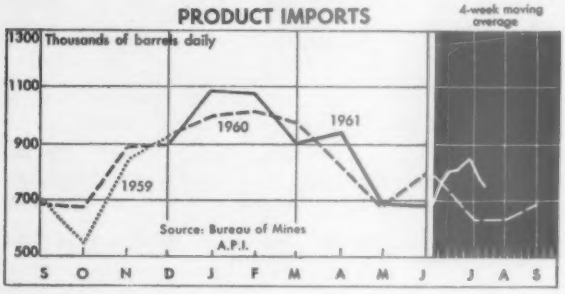


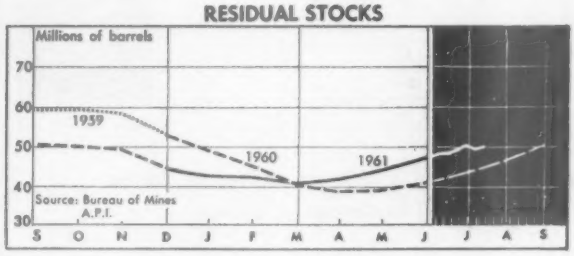












API REFINERY REPORT—AUGUST 11, 1961
(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,106	544.3	31.6	343.8	137.5	46,247	11,282	45,541	13,427	1,128	490.0	33.8	299.7	140.4
Appalachian:														
District 1	75	35.1	2.4	17.6	5.0	5,304	591	2,962	398	94	41.2	3.1	22.5	8.0
District 2	104	55.7	6.0	17.3	9.1	2,650	451	1,308	334	109	53.5	3.8	19.7	10.5
Ind., Ill., Ky.	1,571	816.3	83.4	363.4	133.9	31,950	6,452	24,807	5,650	1,511	693.1	64.8	262.0	130.9
Minn., Wis., Dak.	132	60.8	3.9	34.9	17.6	6,949	1,495	6,839	824	132	38.5	2.0	17.7	15.2
Okla., Kans., Mo.	770	431.0	10.1	168.9	23.3	17,490	1,752	12,017	964	752	384.8	13.7	150.5	16.8
Inland Texas	318	221.4	5.6	54.9	23.3	7,367	583	1,591	2,721	308	211.3	8.3	49.7	21.2
Texas Gulf Coast	1,944	1,000.4	97.3	527.7	110.6	25,119	3,614	16,869	5,142	1,886	972.7	87.7	448.1	137.1
La. Gulf Coast	730	373.7	69.7	157.3	39.3	10,540	2,492	6,135	1,365	679	390.6	53.0	139.1	47.5
N. La. and Ark.	116	67.6	5.0	24.7	4.7	6,257	1,026	1,747	165	109	69.4	3.7	26.4	6.8
Rocky Mountain:														
New Mexico	27	14.4	0.4	5.6	3.3	705	57	168	41	26	12.5	0.4	4.2	2.1
Other Rocky Mt.	306	138.1	6.0	60.1	31.9	6,074	653	2,764	1,077	313	139.6	6.5	60.8	34.7
West Coast	1,238	535.6	49.3	184.7	241.8	25,446	1,675	15,179	17,897	1,203	563.4	39.1	204.9	285.3
Aug. 11, 1961	8,437	4,294.4	370.7	1,960.9	781.3	192,098	32,123	137,927	50,005	8,250	4,060.6	319.9	1,705.3	856.5
Aug. 4, 1961	8,466	4,375.1	391.0	2,005.3	886.7	193,042	32,300	132,875	49,758	.....	.....	.....	.....	.....
Aug. 12, 1960	8,335	4,287.9	403.3	1,902.0	870.0	191,838	31,224	140,647	43,969	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14.14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	(†)	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27-9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	.281	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33-9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Breckenridge	4.0
Illinois Basin	**3.00-3.05**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41.0°-41.9°, Umm said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Weyburn (light)	2.085
Midale C	1.71
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaqin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS+25%)	$3.56
★ Carib.-NY, dirty (ATRS—51.25%)	1.34
★ Carib.-UK, dirty (Scale—60%) (13s. 0d.)	1.82
★ PG-NY, dirty (ATRS—67.5%)	3.87
★ PG-Japan, dirty (USMC—63.75%)	3.70

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless other wise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.00-11.25
★ Premium (99 octane	13.75-14.00
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75-11.00
Regular (92 octane)	11.00-11.25
Premium (98 octane)	12.00-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.60
Premium (94 octane)	12.60
Premium (100 octane)	14.10
Caribbean area (cargoes):	
Regular (87 octane)	8.875
Premium (97 octane)	11.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-9.75
Diesel oil (58 d.i. and above)	9.00-9.25
Distillate No. 1	9.00-9.25
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.50
Distillate No. 2	8.50
New York Harbor (barges):	
Kerosine 42-43	11.20
Distillate No. 2	10.20
Diesel fuel, 48-52 d.i.	10.35
Caribbean area (cargoes):	
Distillate No. 2	8.25

RESIDUAL FUEL

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.65-1.75
Gulf Coast (cargoes):	
Bunker C fuel	2.20-2.30
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C fuel	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

Classified Advertising

. . . your market place for the oil and gas industry

RATES:

- UNDISPLAYED CLASSIFIED: 30c a word per issue. 10% discount for three or more consecutive issues. $5.00 minimum charge. Blind box in our care count nine extra words. Not subject agency commission.
- DISPLAYED CLASSIFIED $20 a column inch one issue. 10% discount three or more consecutive issues. Minimum size one inch Subject to agency commission.
- All classified payable in advance.
- DEADLINE: Copy to reach The Oil and Gas Journal not later than 9 a.m. on Wednesday preceding date of publication. Send advertisments to Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

FOR SALE EQUIPMENT

XVG-6 Ingersoll-Rand gas compressor with cylinders to fit requirements. Worthington 7" x 9" skid electric driven gas compressor. Alfred B. Kern, 305 Kennedy Building, Tulsa, Oklahoma.

6" DRESSER COUPLINGS
Style #40, 24" Long, for Steel Pipe.
Complete with Gasoline Resistant Gaskets.
Unused Surplus $10.75, Regular $31.50
OLDFIELD EQUIPMENT COMPANY
430 W. Seymour Avenue, Cincinnati 16, Ohio
Phone: VAlley 1-5582

FOR SALE
GASOLINE PLANT EQUIPMENT
Located—Bishop, Texas and Magnolia, Arkansas
Absorbers—Towers—Vessels—
Up to 2100# w.p.
Tanks—Reboilers—Electric Motor-Driven Centrifugal and Reciprocating Pumps—Atmospheric Coolers—Heat Exchangers—Compressor Cylinders—Boilers—Meters—Regulators—Generators—Building—Cooling Towers—Valves—Miscellaneous Tanks including 10,000 Bbl. Floating Roof.
All Material Excellent Condition
Complete Inventory Available on Request.
MID-STATES PIPE AND SUPPLY CO.
P. O. Box 2534 Phone LUther 2-9128
Tulsa, Oklahoma

LIQUIDATION
at WHITING, IND.
COMPRESSORS
3—2495 CFM @ 205 PSI Steam Driven
3—11840 CFM @ 325 PSI Steam Driven
1—2760 CFM @ 325 PSI 800 HP
DRUMS
8' x 30' 222 PSI Design
6' x 15' 342 PSI Design
6' x 22' 1260 PSI Design
TOWERS
8' x 63'—18 tray 390 PSI
7' x 83'—30 tray 342 PSI
4' x 83'—34 tray 222 PSI
PUMPS—EXCHANGERS—VESSELS
Write for Inventory
Send Us Your Requirements
HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.

FOR SALE EQUIPMENT

FAILING 1500 GOOD machine also pulling unit, and Vermeer trencher in east Kansas. J. E. Newton, 238 South Elm Ave. Webster Groves, Missouri.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 1 80 ft. flare stack; 4,225 HP Clark Centrifugal Compressor 9,920 CFM 240 PSI discharge Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

AT N. LITTLE ROCK, ARKANSAS
3—Worthington #LTC-4 compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle. gas-engine drive.
Phone POplar 3-3505
PERRY EQUIPMENT CORP.
1402 N. Sixth St.
Philadelphia 22, Pa.

1800 HP WESTINGHOUSE GAS TURBINE
Driving Two
CLARK CENTRIFUGAL COMPRESSORS
2 compressors in tandem, Model 2M5, 7000 CFM AIR, 100 PSIA. Will Separate.
M. L. Groban
9656 S. Merrion Ave., Chicago 17, Ill.
Phone SAginaw 1-3442

USED EQUIPMENT SALE
at DX Sunray's Tulsa refinery
Solvent Dewaxing Plant
Filters, Presses, Condensers, Chillers, Exchangers, Pumps, Compressors, Motors, Vessels.
DX SUNRAY OIL COMPANY
P. O. Box 381, Tulsa
Inquire L. G. Wells
Phone LU 3-4300

LOCATED HOUSTON, TEXAS
(from Amoco Refinery Co., Destrehan, La.)
HEAT EXCHANGERS
900 to 3,500 sq. ft.
VESSELS—TOWERS
12" to 8' dia.
PETRO-CHEM FURNACES
½MM, ¾MM—1¼MM B.t.u./Hr.
PUMPS
50 to 7,000 GPM
—WIRE—PHONE—WRITE—
BRILL EQUIPMENT COMPANY
4101 SAN JACINTO ST., HOUSTON 4, TEXAS
35—65 JABEZ STREET, NEWARK 5, N. J.

FOR SALE EQUIPMENT

FOR SALE: One Cooper double drum model W servicing machine. 3 sheave 50 ft. single pole 8⅝ x 7 mast, Jerkline spudder, 4,000 ft. ⅝" wire line, mounted on 1954 Chevrolet tandem truck, with tool boxes. Machine and truck in very good condition. Award Pursley, Le Roy, W. Va. Phone Ravenswood, W. Va., BR 3-4005.

Trailer mounted Franks 2,000 rotary, GMC Diesel, 53-ft. mast 8½-in. rotary, 5½x8 G.D. pump, GMC Diesel, 4,000 ft. 2⅞-in. drill tubing. 300 ft. 4½-in. drill collars, 1957 IHC 200 tandem tractor, K8 tractor, Chevy A frame winch truck, two 35-ft. tandem trailers, light plant, etc., etc. All in good cond. Location Grand Junction, Colo. Total price $50,000. Junction Drilling Co., 2011 Glenarm. KE 4-0253.

LIQUIDATION
at ESSO REFINERY Balto., Md.
MOST EQUIPMENT NEW 1956
TOWERS—30" to 84" diameter, 20' to 97' high, 7 to 34 trays, up to 360 PSI
DRUMS—3' to 12' diameter, 12' to 45' long to 530 PSI, some lined—some NEW
PETRO-CHEM FURNACES—30.7; 19.3; 10.4; 9.7; 7.5 MM BTU/Hr.
NEW FURNACE TUBES—4000'—⅜" & ½" Wall Croloy 5—4" to 6"
PUMPS—88 to 400 GPM up to 2040' head—up to 8 Stage
HEAT EXCHANGERS—CONDENSERS
Stainless Tubes —235 to 2320 Sq. Ft.
Croloy 5 Tubes —573 to 1040 Sq. Ft.
Admiralty Tubes —216 to 1640 Sq. Ft.
Steel Tubes —238 to 2240 Sq. Ft.
COMPRESSORS & BLOWERS
7500CFM @ 42.5PSIG, 1250HP Synch.
129CFM @ 193PSIA Worth. HB 7½x9
LARGE QUANTITY
TRANSFORMERS & MOTORS
WRITE FOR CATALOG
HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.
Boston & Haven St., Baltimore 24, Md.

FOR SALE EQUIPMENT

FOR SALE Two U-15s, excellent condition, complete in every detail. Inventory and price on request. Box M-492, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPLETE DRILL stem testing unit. Wire line truck with temperature and pressure recorders. Latta Precision Service Company, 1354 Crescent Drive, El Dorado, Kans.

(8) 96,000 Bbl. 120'x48'
WELDED CONE ROOF
OIL STORAGE TANKS
INSTALLED NEW in 1952
Dismantled, Matchmarked For
Reerection $75.00 N.T.
FOB Baltimore, Md.

HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N.Y.
Boston & Haven Sts., Baltimore 24, Md.

COUPLINGS TO SWAP

We have large quantities of 10¾" and 13⅜" O. D. New Casing Collars to trade for various sizes of Casing or Line Collars. Can also use 2" and 2½" upset or non-upset Couplings. What have you?

Write, Wire or Phone (COLLECT)

Jim Fontana
PRospect 3-3020

VALLEY STEEL PRODUCTS CO.
124 Sidney St. St. Louis 4, Mo.

NEW TUBES ADMIRALTY
25% OFF MILL PRICE

234 1¼" x 13 ga. x 20'
76 1½" x 14 ga. x 9' 10"
176 1½" x 14 ga. x 10'

BANKOFF PIPE & SUPPLY, INC.
Box 2479, Tulsa, Okla.
Phone LU 7-2511

50,000 ft. 20" No. 1 grade used pipe.
Lengths 20 ft. square cut ends.
Weight 78# to the ft.
High Tensile Pipe.

Indiana-Ohio Pipe Co.
P. O. Box 5462 Shep. Sta.
Columbus 19, Ohio
Phone CL 2-5527—CL 2-5528

USED LINE PIPE

2⅜" O.D., 3.65#	87,000'
3½" O.D., 4.51#	32,000'
4½" O.D., 5.97#	27,000'
6⅝" O.D., 11.8#	15,000'
8⅝" O.D., 16.9#	17,000'
10¾" O.D., 20.3#	4,000'
12¾" O.D., 25.16#	2,000'
14" O.D., 27.66#	2,000'
16" O.D., 31.66#	3,900'
18" O.D., 35.67#	6,200'
20" O.D., 39.7#	2,400'

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1000 Liberty Bank Building
Oklahoma City 2, Oklahoma

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OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs. $5.00 cash OIML Co., Box 2803, Tulsa, Oklahoma

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BOX M-527,
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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Box M-519
The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

REFINERY ENGINEER—Graduate engineer, preferable B.S. in mechanical engineering with at least two to three years refinery experience, to supervise scheduling of maintenance, new construction, etc., for modern refinery in mid-continent area. Our employees have been informed of this advertisement. Box M-518, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

LAND MANAGER, LLB Degree, 10 years' experience, 6 with Major, 4 as Manager for Independent. Qualified to manage small oil company or division, specialize in well deals. Experienced Gulf Coast, Mid-Continent, Rocky Mountains, Alaska, some foreign. F. C. Nance, FL 2-7107, 3605 Duchess Trail, Dallas, Texas.

PALEONTOLOGIST, 44 single, desires overseas position with oil company. 15 years experience with Tertiary and Cretaceous Foraminifera, and ammonites, in California, Colombia and Libya. Some field and wellsite work. Knows Spanish, learning Arabic. Box M-465, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION MAN thoroughly experienced in producing properties, well completions, and workovers wants position as production foreman or superintendent with growing independent. References upon request. Will relocate. J. E. Hodges, 1843 Westridge, Wichita, Kansas.

ENGINEER, EXTENSIVE experience in United States, Europe, and Africa, exploration and production. Languages: French, Italian. Desires position with American company, preferably in Europe. Contact Box M-520, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER seventeen years intensive, broad background in Budget Administration, Economic Evaluations, Cost Analysis, Establishing Accounting Procedures, Manpower and Efficiency Studies, Operations, Technical Supervision, and Petroleum Refining. Box M-522, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERING GEOLOGIST 26, Vet., B.S. Degree. 3 years diversified experience in oil industry. 18 months as manager of Foreign operation, contacting clients, and high level sales. Desires employment as sales engineer with managing potential. Foreign or domestic. Good references. Presently foreign employed. Box M-528, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, B.S., 35, 11 years diversified experience administration, project and process engineering, construction, startup, economic studies, coordination entire projects refining and natural gas fields. Domestic or foreign. Box M-531, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS production man. Experienced in drilling, completion, workover, production, and general management in Mid-Continent and Appalachian areas. Excellent references. Box M-542, The Oil and Gas Journal, Tulsa, Oklahoma.

SENIOR PETROLEUM Engineer — seeks foreign or domestic position. 10 years production experience. 6 years supervisory and administrative. Request replies contain particulars. Box M-541, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER—MANAGER. Seventeen years diversified experience, drilling, production, oil property evaluation, reservoir engineering, production manager. B.S. degree Petroleum Engineering. Complete resume on request. Box M-535, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS ENGINEER and Commercial Pilot. B.S. in Petroleum and Natural Gas Engineering. Experienced in design, installation, and operation of gas distribution system. Resume on request. Box M-536, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Eleven years with major, one with independent producer. Wide range of experience, everywhere except Gulf Coast. Will relocate. Box M-537, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS ENGINEER—36. Want more work and responsibility. Ten years experience, five supervisory. All phases gas sales and engineering. Presently employed. Will travel. Consider any phase gas industry. Personable and reliable. Box M-538, The Oil and Gas Journal, Tulsa, Oklahoma.

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Independent operator has $1,000,000 for proven development drilling during remainder of 1961. Interested primarily in gas. Will make very equitable arrangement. Not interested in speculative or marginal prospects. Brokers protected. Write: Box M-521, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION FOR SALE

FOR SALE: All assets Amtex Oil Co., Inc. Write Robert Whiting, A. and M. College, College Station, Texas for particulars.

REAL ESTATE

WARTON, TEXAS, 3 miles from downtown, Wharton, located 0.4 miles East of Highway 59 North. Formerly used as Field Operating Hq's by Magnolia Petroleum Company, Natural Gas Dept. Lots 14, 15, & 16 of Block 2, Peach Acres S/D, tract being 218' x 300', enclosed with 6' cyclone fence. 100' x 30' steel office and shop building, small out buildings, all in excellent condition. Butane tank, electricity, water and paved driveways. Ideal for Field Office or Pipe or Supply Storage. Open for inspection each Tuesday in August or open by appointment—Call Land Dept., Mobil Oil Co., Houston, Texas, FA 3-6121. Mail sealed bids to Mobil Oil Co., Box 56, Houston, Texas, Attention: Wharton Property Sale. Bids must be postmarked before Midnight, September 1, 1961. Bids will be opened September 11, 1961, Mobil reserves the right to reject any or all bids.

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Box M-534, The Oil and Gas Journal
Tulsa, Oklahoma

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trimmed in ornate wrought iron on choice 2½ acres in choice section Denver. Has fabulous mountain view. Only 4 years old. Elegantly decorated. Beautiful carpets and drapes. Spacious rooms: Living room 19x23 with wood burning fireplace, Family room 15x30 with wood buring fireplace, kitchen and breakfast combination, Dining room 16x14, Master bedroom 19x16 with large dressing room and bath, Utility room with bath, all on the main floor. Large covered patio. Circle front driveway. Upstairs: 2 bedrooms 20x20 and 17x20 with 6x18 bath. Spacious closets for every accommodation. Finished basement game room 40x40. Two car attached garage. Barn to accommodate three horses, lot and small pasture. Very reasonably priced $92,500.00 Location Cherry Hill district. Write:

D. B. Yarbro, #3 Vista Road, Englewood, Colo.
Phone SU 1-3791

LEASE AND DRILLING BLOCKS

GOOD PROSPECT. 6,500 acres within mile of good very shallow oil production. Reasonable. Box M-533, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

COLORADO, RIO BLANCO County 40 acres. Section 13: T 2 N, R 102 W, 40 acres Logan County Section 25: T 9 N, R 102 W. Federal leases. Box M-539, The Oil and Gas Journal, Tulsa, Oklahoma.

200 ACRES Near Production on Stratton Ridge, Brazoria County, Texas. Brokers invited. Wallace Miller, 2812 Glendale Blvd., Los Angeles 39, Calif. NOrmandy 4-1913.

80 ACRES landowner's royalty Woods County, Oklahoma. Good geology. Leased major company. Box 812, Oklahoma City, Oklahoma.

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HIGH GRADE DEVONIAN oil in wild cat. State log with analysis of samples. Geologist recommendation. Other confirmation. Clark County, Ill. Will farm out block for offset. Small override. W. V. Tarman, Martinsville, Ill. Phone 128.

SOUTHWEST CRANE County, Texas: Oil and gas lease, five years primary term, S/239 acres, section 18, Block B-28, PSL survey, 2 miles from new oil gulf devonian shows in sec. 15, Blk. B-28, PSL, Ward County, Texas. Great potential bargain. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

5,000—15,000 ACRE BLOCKS—ten year leases. Good play areas. Ohio-West Virginia Production. Box 393, Marietta, Ohio. Phone 373-6862.

PROSPECTIVE OIL LEASES: Am fee landowner over 2,000 acres near Pan American Petroleum Corporation No. 1 List, Sec. 23, Block 68, Township 1, T&P Survey, stratigraphic test, projected to 8,500 feet. Anticlinal axis nearby, Hudspeth County, Texas, leases available Hudspeth, Crane, Terrell Counties, Texas. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

PENNSYLVANIA LEASES available near Sinclair new secondary recovery test. Contact Z. Jeanette Perell, 2833 Glenwood Pk. Ave., Erie, Pa.

DRILLING CONTRACTOR: Johnson County, Wyoming 40 acres near Sussex Oil Field Federal lease Sec. 21 SE¼, SW¼, T 43 N, R 78 W. Ronald W. Menz, 1231 South 30th Street, Milwaukee 15, Wisconsin. Phone ORchard 2-4044.

1,500 ACRES, more available, 1½ miles from 7 million gasser, 2,500' pay. Three miles to pipeline Northern Montana. Box M-532, The Oil and Gas Journal, Tulsa, Oklahoma.

MUST SELL MY choice federal oil and gas leases at cost prices because of illness. Contact Box M-530, The Oil and Gas Journal, Tulsa, Oklahoma.

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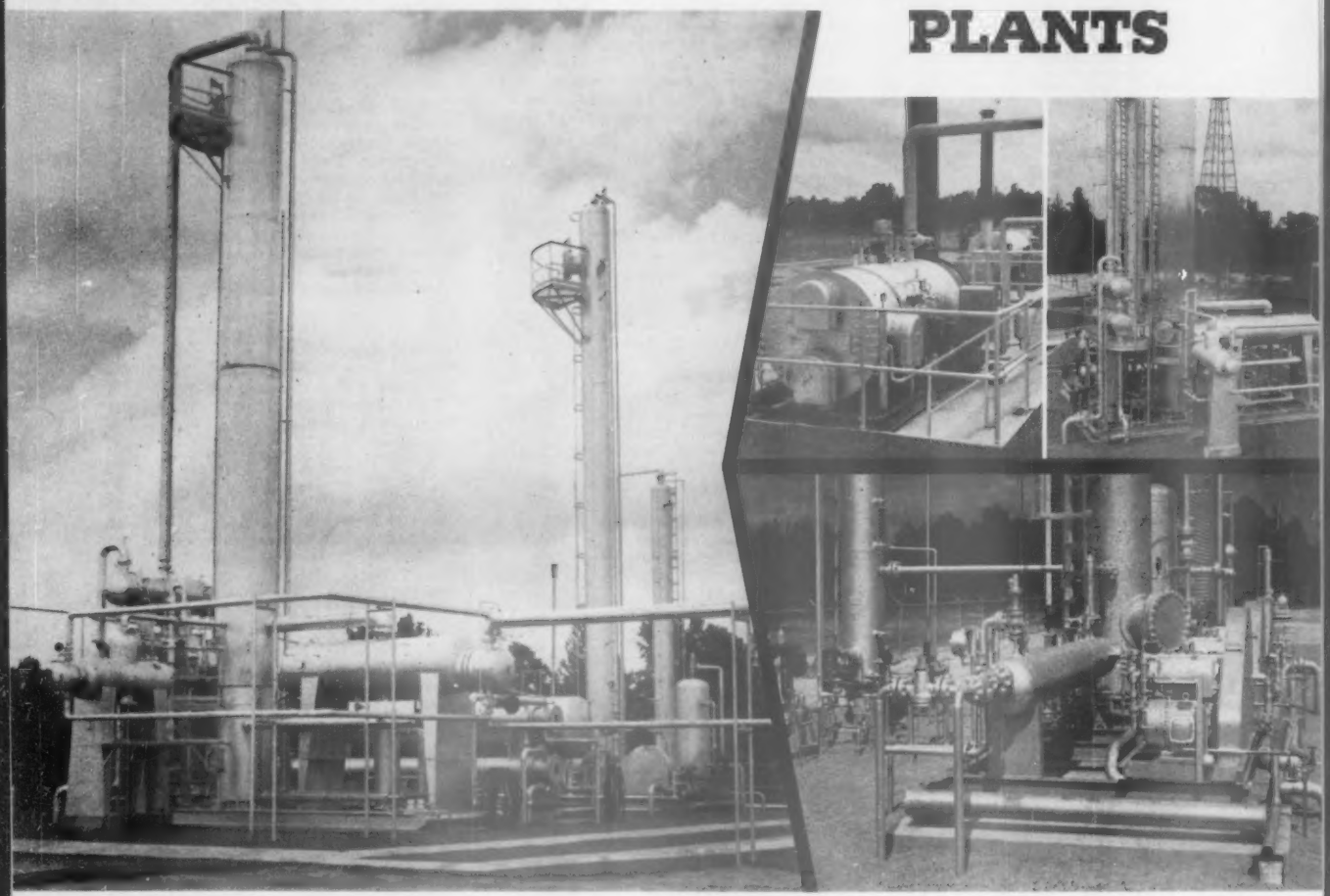

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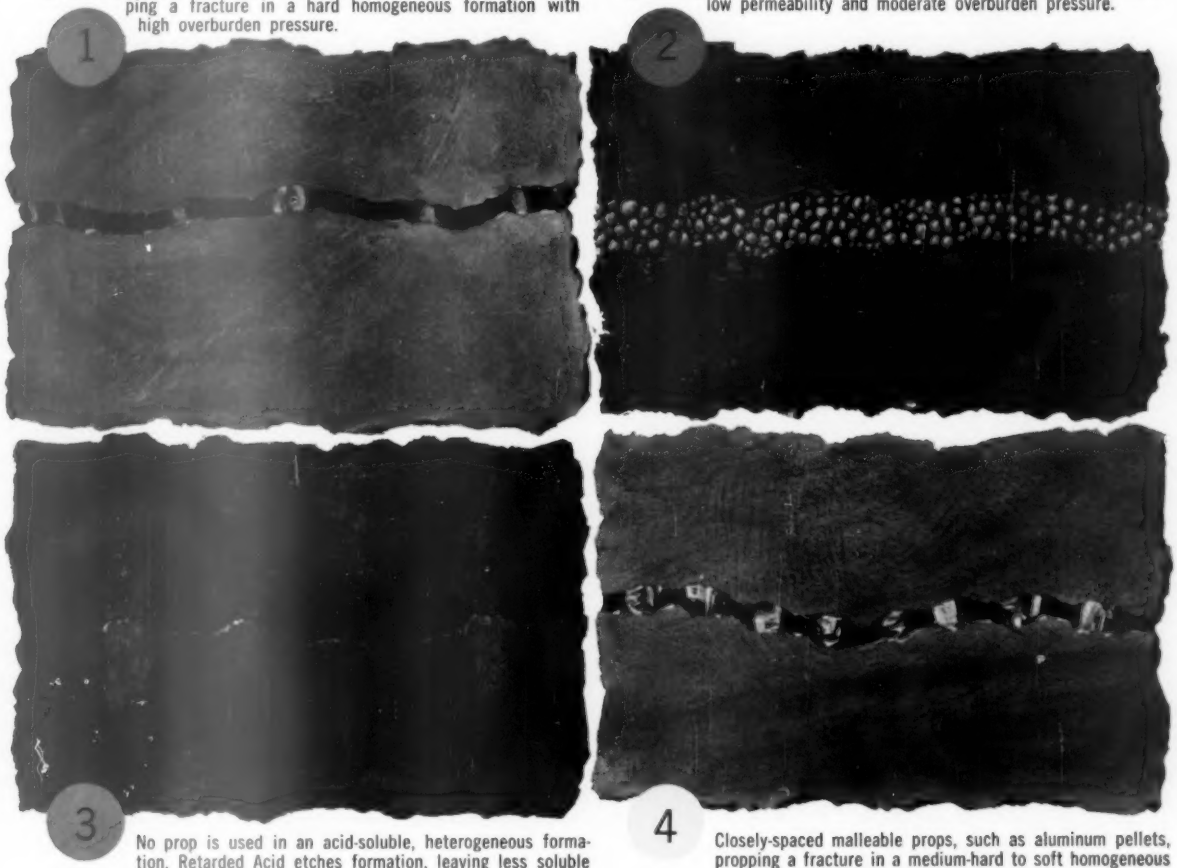

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